Electrical World

The consolidation of Electrical World and Engineer and American Electrician
Published by McGraw Publishing Company, Inc.

Vol. 62 NEW YORK, SATURDAY, AUGUST 30, 1913 No. 9

Progress in Incandescent Lamps

Numerous papers read at recent conventions show how far the present metallic-filament lamps are in advance of those produced only a few years ago. As our readers thoroughly appreciate, the great change has been in the substitution of the drawn-wire filament for the older sintered filament, a change which has practically at least doubled the strength of the filament so far as tests under transverse load go. What is less well known, however, is the very great improvement in both types of filament since the beginning of their manufacture. The best sintered filament is immensely stronger than that produced half a dozen years ago when the tungsten lamp first came into use, and even since the drawn filament has come into use great improvement in its strength has been made. Another and very important matter is the use of chemical absorbents in the globe to check the blackening of the bulbs. This practice has not yet become standardized, but the results are extremely promising. One feature of the manufacture much to be commended is the standardization of the size of the bulbs, so that from now on one may hope to get lamps in regular dimensions which will give consistent results when used with their suitable shades. There have been so many changes up to the present time in the dimensions of the lamps that it is exceptional to find in actual use lamps which really fit the reflectors in which they are installed. Another change for the better due to the advance of the drawn-wire filament is the possibility of using filaments wound into a helix which gives a powerful source of light of very small dimensions, suiting it admirably for use with concentrating reflectors and also enabling it to be employed usefully in miniature bulbs of the types utilized in candelabra and for decorative purposes. Until very recently small lamps could be obtained only with carbon filaments, while in the future tungsten will be very largely employed, the illuminating engineer thus obtaining a corresponding greater degree of freedom in planning artistic and effective fixtures.

Designing for the Ultimate Consumer

Individually driven machine tools have been used long enough now for the problem of their disposal at second hand to receive consideration from motor-service engineers and designers. It is not necessary, of course, to give to the question of ultimate ownership too much weight in planning an individual electric drive for a machine tool, but many electrical engineers do not realize that the second-hand value of such a tool complete may be much increased if a flexible motor arrangement is provided, and particularly if a standard motor can be adapted to the initial requirements. Other things being equal, a machine will bring more when re-sold if its motor is detachable, if the brackets and gearing spaces allow for the substitution of another motor to adapt the tool to different service, and if the motor application is simple mechanically, reasonably quiet in operation and provided with a flexible control From this point of view it is possible to build a motor-operated machine with too crowded a drive and to pay too little attention to the possible needs of the later owner in lines of industry subject to rapid changes in productive equipment. Machine-tool users sometimes complain that the market for second-hand motor-driven apparatus is too narrow, and while the subject has not yet attained serious importance, it is a matter to which the experienced designer may well give more thought.

The Hotel Customer

Among the few comparatively large prospective users of central-station service in the average community, the local hotel load is altogether too often regarded as impossible of attainment by the commercial department, and an isolated plant is installed, costing its owners oftentimes unwarranted operating outlays and taking from the central station desirable and appropriate business. The difficulty seems to be to get the hotel management to count all the costs of manufacturing its own service. Hence data like those presented by Mr. C. A. Collier before the recent Southeastern convention will help greatly in demonstrating to the hotel-keeper the actual economy of purchasing electricity and steam heat. The hotel business is one of infinite detail, and the management that devotes its talents to purchase of provisions and supplies and to catering to the tastes of its guests can hardly be expected to apply engineering analysis to the study of its engine-room problems. In fact, the wise manager will aim to relieve himself of all such unnecessary detail. Evidence of this is afforded in the insistence with which hotel men argue for flat blanket prices for electrical energy and for steam heat. If central-station companies will furnish them all the electric and steam-heating service they need at a fixed price per month, many of them declare they would willingly contract for central-station service and shut down their isolated plants. The thing to do, however, is to point out to a hotel man that a flat rate for electric service is as irrational as the decadent "American plan" in his own business, a wasteful flat-rate principle which progressive central-station and hotel managers everywhere are drawing away from. It ought not to be difficult to convince the manager of a modern European-plan hotel that it is inconsistent for him to demand a blanket price from the central station any more than from his butcher or grocer for all the supplies his hostelry might demand, while he at the same time is insisting on a schedule of charges to guests which itemizes

room, meals and each miscellaneous service. The matter must be handled with diplomacy, however. As a user of energy the average hotel has a large connected load, as well as a load-factor about double that of the usual office building, department store or newspaper office, and although this class of business may have been overlooked or misjudged in the past, it is nevertheless a central-station opportunity calling for the concentration of all possible selling talent.

Combination Generating Systems

Of the advantage of grouping a number of local distribution systems into a single network little need be said. By generating electrical energy on a large scale and distributing it efficiently the cost of production and the ultimate selling price are greatly reduced. Besides, there are the other advantages of reliability of service brought about by better engineering and more expert supervision. Reconstruction work such as that outlined in connection with the Gorge station of the Northern Ohio Traction & Light Company gives an excellent insight into the needs of such combinations and the economies resulting therefrom. Wherever uniformly good methods supplant a mixture of good and bad, wherever inefficient stations are replaced by a single modern plant, and wherever operating problems are dealt with as a whole instead of in fragments, economy is to be found, and invariably financial stability as well. It is not sufficient, however, to bring properties under a common ownership; their prosperity depends just as much upon a unified system of management, and particularly one which has not lost local touch. The station described in this issue is built along standard engineering lines modified somewhat in order to take advantage of the favorable site upon which it is erected. One commendable feature possessed by it is a pleasing exterior, and it is refreshing to note that the tendency in the industry is more and more toward structural design which will be in keeping with the dignity and importance of the utility and will not jar the sensibilities of the community in which it is located. Electricity, unlike gas, has always been associated with what is clean, neat and artistic and it is fitting that the power house should also convey the same impression.

Suspension Insulator Defects

Transmission companies have experienced more or less trouble of late with insulators owing to the cracking of the porcelain. In a great many cases in both Canada and this country interruptions in service have resulted and in not a few instances a thorough inspection of entire transmission systems has been necessary in order to locate and throw out the faulty insulators. This is a defect which no designer could foresee and which only time would bring to light. However, it is a problem which ceramic engineers must investigate and solve, because transmission lines are becoming too important for such a condition long to be tolerated. In this connection it will be remembered that Mr. A. O. Austin in discussing the mechanical and electrical stresses in high-tension insulators before the recent convention of the National Electric Light Association pointed out that dead-end strings of insulators are often subjected to severe mechanical stresses, not merely by reason of the dead-end tension they carry, but also because of the differences of expansion with temperature in the steel and porcelain, or in the cement, of which they are built. Special attention should, therefore, be paid to the mechanics of strain insulators, or dead-end insulators, in a high-tension transmission line.

As a protection against heavy surge over-voltages, a lateral air path has proved useful for strings of insulators. The lateral air path must be capable of breaking down immediately when a severe over-voltage occurs and before the insulators in the string, or any of them, can spill over. On the other hand, the lateral air path must mend itself as soon as the voltage falls to normal and must never break down under normal voltage. The ratio of the total dielectric strength of the insulator string to that of the lateral air path—called the factor of safety of the string—under those conditions may vary from 1:6 to 2:3 according to the observations quoted.

Rate Regulation by Commissions

The most remarkable feature of rate regulation by some of the prominent public service commissions is the boldness with which the problems have been attacked. The charge is frequently made that the chief sources of this boldness are inexperience and an absence of any responsibility for the income account; but the commissions feel that they have been appointed to regulate, and that they have no choice but to act. That their action is sometimes ill-timed, that emphasis is frequently misplaced, that they often do violence to old-established and cherished customs and traditions, and that the immediate results are not always happy, cannot be denied. However, able and conscientious commissions in some of the states have given scientific consideration to rate and other matters over which they had jurisdiction and have had co-operation from the companies in these activities.

The difficulties of the rate problem itself and those of the commission which attempts to solve the problems are discussed in a stimulating paper by Mr. William J. Norton, secretary of the rate research committee of the National Electric Light Association, abstracted in this number. The suggestion of "preliminary" and "final" periods of rate regulation raises the question of the responsibility of the commission to the company as well as the responsibility of the commission to the public. A preliminary period should vary in length and importance according to the circumstances affecting each case and it should give a company all possible protection of the reasonable investment before complete regulation takes place. A loss of time, if the time is devoted to the perfection of a permanent, satisfactory solution, is not a grave matter in so serious a problem. The entire structure on which a great industry has been built should not be disturbed hastily. The end desired in regulation is a working arrangement that protects the company and its employees against the ill-judged demands of the public and protects the public against unreasonable practices on the part of the company. Such an arrangement should not be sought by methods that exclude the financial fabric of the structure from consideration. The

plant was given existence and efficiency by investment, and regulation should be tempered by the desire to render justice to those whose hazard of capital made the property possible.

Since the advent of commissions many operating men and others making a study of rate schedules have been compelled to go on the witness stand and submit to searching questions as to the basis on which the schedules are built. Sometimes the result of these questions has shown the schedules to be a kind of conglomerate without clear limits. The excuse of commercial necessity is not one that a commission could adopt without analysis. By law a commission was created to regulate, and it had to be in a position to give some explanation for the particular action it took. It has chosen to regard a set of rate schedules, not as a conglomerate, but as a structure of closely related parts, which must have the qualities of reasonableness, maximum consistency and minimum discrimination—and sometimes the factor of commercial availability, which we regard as a necessary one, has been included.

The commissions should realize clearly that perfection in a schedule composed of varying rates to meet different conditions and requirements is impossible of attainment. The schedule must stimulate the business or it is useless. If a rate does not take into consideration "what the traffic will bear" the business will be diverted to other channels. Strong arguments are advanced in favor of schedules based on this consideration. These arguments, if honestly made, assume the existence of a free or natural rate which will be discovered by the exigencies of getting the business. If such a system were always to be established by sagacious business men, controlled by intelligent self-interest, all the features of a schedule insisted upon by a commission would undoubtedly be introduced, and the final result would probably not be very different from that obtained by any other avenue of approach.

Enlightened self-interest on the part of the company would recognize the interest of the public in its affairs. But why should not enlightened self-interest, inducing co-operation between the public and corporations, be the keynote of the solution of the whole problem? Could not the companies more frequently take up the regulation of their rates themselves and, with the aid of long experience and ample knowledge, leave as little as possible for the commission to do?

The germ of commission control is that the public has an interest in the business and that it should have an agent to protect its interest. A frank acknowledgment of this interest and a practical demonstration of it by real co-operation would do much to remove any existing differences and imaginary menaces. With both interests properly protected, the public should have no more desire to withhold reasonable franchise conditions than the company to withdraw its investment. Unfortunately the public can withhold proper franchises while the company cannot withdraw its investment. If extraordinary operating ability were rewarded simultaneously with proper adjustment of rate schedules, would not the shadow of periodic enforced regulation downward be removed? Co-operation is asked for and it ought to be given, by all means, by both the commissions and the companies, not in a spirit of give and take or of idle compromise, but in one of constructive progress.

Radio-Telegraphy and Clouds

The consistency of the observations from which Prof. A. H. Taylor draws the conclusions presented in his article on "Wireless and Weather," printed in this issue, invites further speculation as to the explanation of the connection between absorption and cloudiness. Such conditions as those reported for the night of March 19, when the effect of prejudicial previous impressions was practically nullified by complete alteration in the meteorological situation as it bore on radio-transmission, together with the impartial method of recording which becomes the habit of a skilled physical observer, make it appear unnecessary to question the existence of a functional relation between ease of night transmission and earlier cloudiness in the region between the sending and receiving stations. The problem would seem, rather, to determine just how these effects are connected.

Professor Taylor's suggestion that the absorption is atmospheric, and that it is caused by a sun-created conductivity close to the earth's surface (below the normal cloud layers) is a possible explanation of the phenomena. It would appear, however, that the solar ionization at these small altitudes would be too slight to account for such tremendous changes in transmission distance as are noted from night to night. It is generally believed that if conducting layers of atmosphere exist at all they are high above the earth and make themselves felt in radio-signaling mainly by giving rise to reflection effects. There are also supposed to be small conducting portions of atmosphere moderately near the earth (say from 5 to 10 miles above) which may produce transient reflections affecting nearby wireless stations. While these may be involved in the "cloud effect," if it may be so called, it does not seem likely that their action could extend over a territory 1500 miles wide if they were below the usual level of rain clouds.

The role of high-frequency currents in the earth's crust is daily being more seriously considered in connection with the problems of radio-signaling. There is a strong probability that at great distances a very large portion of energy received by wireless is set up by free transverse earth currents. It is known that transmission over water or damp ground is easier than over desert or other dry land. It, therefore, seems easily within the bounds of possibility that the observations of Professor Taylor might be further interpreted by considering that after a cloudy day the earth's surface retains more of the moisture deposited nightly and so permits the passage of radiated waves and their accompanying earth currents with smaller conduction losses. However this may be, the material presented is of interest, and it is hoped that other investigators who have made studies of similar conditions may be prevailed upon to place their data before the radio-engineering public, through our correspondence columns or otherwise. Only by comparison of many observations is there any hope of securing sound explanations of phenomena so complicated as those involved in radio-transmission.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

International Electrotechnical Commission

A meeting of the International Electrotechnical Commission will be held in Berlin, Germany, Sept. 1-5. On Monday, Sept. 1, the special committees on nomenclature and on rating of electrical machinery and prime movers will hold a meeting, and on Tuesday, Sept. 2, the committee on symbols will meet, while the committees on nomenclature and rating of electrical machinery will continue their deliberations. The official opening of the convention will take place on Sept. 3, when the whole commission will be in session to draw up in definite form various resolutions for ratification at the plenary meeting, which will be held on Sept. 5, Sept. 3 and 4 being devoted to the working sessions of the commission. The special committees on nomenclature, symbols and rating of electrical machinery and prime movers, which have been in correspondence and have held sessions from time to time since the 1911 meeting at Turin, will hold meetings in Berlin prior to those of the full commission in order to have further opportunity of discussing the latest modifications to their reports suggested by the national committees. The result of these meetings will be embodied in the reports, which, thus modified, will be considered at the working sessions of the commission. When agreed to in their final form they will be submitted to the plenary meeting for ratification. It is probable that the honor of the presidency of the commission, which would have been conferred on the late M. Mascart had he lived, will be offered to an eminent French electrical engineer by the council of the commission at its closing meeting on Sept. 5.

Electric Service at the Panama-Pacific Exposition

Rules and requirements for electric lighting and motor service at the Panama-Pacific International Exposition, to be held at San Francisco Feb. 20 to Dec. 4, 1915, are contained in the book of general regulations just issued by the Exposition division of works.

In the Exposition buildings 115-volt, 60-cycle, three-phase service will be available, the lighting elsewhere being furnished from 230/115-volt, single-phase, three-wire mains. For motor operation 230-volt, 60-cycle, three-phase and 115-volt, single-phase energy will be supplied. Direct current at 125 volts and 250 volts will also be available during exposition hours in the Machinery, Mining, Transportation and Manufactures buildings, under special restrictions.

All electrical construction work must receive approval and permit from the director of works and is subject to inspection by the Board of Fire Underwriters, the usual fees being charged. Service connection charges will be made at the rate of $25 per service for metered customers in the underground district and $15 elsewhere in the buildings and grounds. For flat-rate customers the respective charges are $15 and $5. Fuse boxes capable of being sealed must be installed.

Service will be furnished under three schedules—flat, metered and special rates. For connected loads of less than 2 kw the flat-rate charge will be $15 per month per kw, and for loads under 166 watts $2.50 per month. Above 2 kw meters will be installed, the customer paying $2.50 per month per kw of connected load, plus an energy charge of 5 cents per kw-hr. for quantities less than 1000 kw-hr. per month. For consumptions above 1000 kw-hr. the 5-cent rate will be reduced 0.1 cent per kw-hr. for each 1000 kw-hr. consumed. Exhibitors not requiring electricity except during night hours will have special service rates 25 per cent below the foregoing rates. Energy to operate moving exhibit machinery will be charged at the rate of 3 cents per kw-hr.

Educating the Public in the Use of Light

Within the past month the Illuminating Engineering Society has printed for several large lighting and manufacturing companies throughout the country an edition of more than 250,000 copies of its illumination primer, "Light: Its Use and Misuse." This little publication presents in a brief and popular form the principles of good illumination. It is being widely circulated for the purpose of creating an appreciation and demand for more and better light. For the companies which are going to issue this pamphlet to their customers during the coming lighting season, the society is arranging to publish two new large editions, which will be available at prices that merely cover the publication costs involved.

Celebrating the Inauguration of Keokuk Water-Power Plant

Keokuk, Iowa—which now styles itself "the Power City"—entered with great zest into its water-power celebration of Aug. 25-28, which marked the realization of a cherished desire extending back fifty years that the available water-power of the Mississippi River at the Des Moines Rapids, estimated at 200,000 hp, should be utilized.

Now, as the readers of the *Electrical World* know, the Mississippi River Power Company is doing the trick with its great hydroelectric plant which dams the river between Keokuk and the little town of Hamilton, Ill. The initial half of the generating station, with fifteen 7200-kw units, is now nearly complete, and the plant is carrying a load of between 30,000 kw and 40,000 kw, and could supply 100,000 kw in a week if customers were ready for it. Eighty per cent or more of the output is transmitted to St. Louis.

The installation is the world's largest individual water-power plant. Mr. Hugh L. Cooper, vice-president and chief engineer of the company, did more than any other one man to bring the plant into being. He is in Europe, but his work was extolled in the highest terms by the various speakers at the Keokuk celebration.

The exercises began in Hamilton on Monday, when Governor Dunne of Illinois was the guest of honor and made a speech. He said it was unusual for the executive of a great state to assist in the opening of a private enterprise, but he understood that this corporation was rather an exception in being fair in its dealings.

Tuesday was the principal day of the celebration at beautiful Rand Park, in Keokuk. There was speechmaking after a fine parade. The Power City was handsomely decorated in honor of the occasion, and its people and thousands of visitors made carnival. Governor George W. Clarke delivered an oration, and there were speeches by Mayor Elder of Keokuk, Lientenant-Governor Tenant of Missouri, Mr. Wil-

liam Logan, the historian of the day, and Hon. W. H. Hepburn, for twenty-two years a representative in Congress from Iowa and still vigorous and eloquent at eighty. Mr. Hepburn was sarcastic in his references to modern theories and tendencies in relation to the conservation of natural resources. Mayor Elder said that when the plant is fully employed it will save the burning of coal at the rate of 3,000,000 tons a year. Mr. Cooper sent a cablegram of greeting from Berlin.

Other features of a very successful celebration were band concerts, an inspection of the dam, generating plant and locks, a motor boat and hydroplane regatta on Lake Cooper, the sheet of water impounded by the dam, and displays of fireworks.

German Patent Legislation

The German government has published the text of three bills which will be read before the Reichstag when it reconvenes. The bills provide for a reform of patent and trademark legislation and are intended to replace the existing laws on the subject. Of particular interest is the new patent bill, which affords a greater protection to the inventor by renouncing the existing point of view that the patent belongs to the party who first applies for it and stipulating that it is the property of the inventor. The vexed question of the rights of employees making inventions on behalf of their employers will thus be settled, since the proposed measure specifies that the patent shall only be the property of the employer if the invention lies in his sphere of business and if the work that has led up to it is part of the employee's duties. In this case the latter is entitled to receive a certain recompense from the employer. Another important point is a reduction in the Patent Office fees. At present the fees increase annually and amount to $132.50 for the first five years in addition to the application fee of $5. It is provided in the new bill that the fees shall be increased from the sixth year only, that they shall aggregate $62.50 for the first five years, and that the application fee shall be increased to $12.50. The bill also contains revised provisions regarding the procedure and constitution of the Patent Office.

Frank E. Watts on the Electrical Development Society and the Individual

In connection with the work of the Society for Electrical Development, the question has often been asked by individuals "What will the society do for me?" Mr. Frank E. Watts, reigning Jupiter of the Jovian Order, has essayed to answer that question simply and concisely.

"In the first place," he says, "a man must understand that only as an industry or business in which he is engaged grows can he grow. He will prosper in the same measure as the company with which he is connected prospers and as its business is developed and enlarged. A greater volume of business for his company means greater opportunity for advancement and promotion to him.

"No man is likely to look into the future with much gratification when he is connected with a business which is on the decline, but he is much happier if he sees the possibility for growth and knows that with that growth will come the opportunity of benefiting himself. The purpose of the Society for Electrical Development is to create a greater demand for the use of electricity and thereby create a larger market for electrical apparatus and appliances of all kinds. A greater demand for electricity means that more houses will be wired, more apparatus for generating electricity will be installed, and more appliances for consuming electricity will be purchased. This, in turn, means that the contractor or individual working for the contractor will have more work to do; therefore the contractor will purchase more electrical supplies and the jobber or jobber's salesman will sell him more material. The jobber, in turn, will necessarily purchase a greater quantity of electrical goods from the manufacturer through his representatives, and in the final analysis the central station will sell more energy, and every man in its employ should benefit thereby.

"Every branch of the industry is affected by an increased demand for electricity, and this means greater opportunity for every man in the business, whether he be in the factory, in the office, in construction work, a salesman for jobber or manufacturer or a member of the company.

"The more rapidly the electrical business develops, the larger the opportunity of the individual. To develop the business more rapidly is the purpose of the Society for Electrical Development, and for this reason alone it deserves the support of every man who will be affected by such development and growth."

Electric Heating and Lighting in England

BY DR. LOUIS BELL

One of the things which seem to be uppermost in the minds of the municipal plant operators in England is the heating and cooking campaign, which is now fairly under way. The apparatus seems to be good and cheap, and with energy at 2 cents per kw-hr. or less the outlook for business should be good, or as good as it could be at so low a figure. Thanks to the relatively great density of service of every kind, the price quoted is a possible one.

One thing which is constantly forgotten in comparing the English with the American situation is that the former for a given output shows a much shorter average radius of distribution. An English town is ordinarily rather compact and the scattered suburbs stand a fair chance of getting no service. An English operator simply will not as a rule serve a rural community of the kind that an American operator feels bound to serve. In fact, the necessary cost of the practically universal underground distribution makes rural service out of the question. Add to this the fact that a somewhat wider margin in voltage regulation seems to be common, and it is not difficult to see that distribution costs run fairly low and business, when well developed, is really secured at a good density.

The high-service density seems to be at the root of the low prices referred to. In fact, a rather violent discussion is now going as to whether 1 cent per kw-hr. is not the right level for motor and miscellaneous load, and such a rate is now being offered in several municipalities. In taking on heating and cooking work a separate meter is used and the cost of special wiring to the consumer acts as a check on rapid increase. But there seems to be fresh trouble ahead, and those who make rates are sorely perplexed.

We have heard recently in America whisperings of a half-watt-per-candle lamp. Over in England the whisper has risen to a stage volume easily audible over a rumble of strong language from the supply companies. Thus far the half-watt lamp seems to be located, like malaria, always in the next county. There are plenty of skeptics, in fact, who have their doubts as to whether the half-watt lamp is more than a bad belief.

There seems to be a growing opinion that if the situation becomes fully developed it may lead to selling light as light, and not merely selling energy to produce it. Some of our own cities are experimenting with such a plan—practically a fixed charge per candle-power-year or month with liberty to use the lamps all the time if desired. The actual result is a reasonably good price on the energy basis and no very serious abuse of continuous-service privileges. But English opinion is really quite at sea in the matter, and the one thing plainly evident is that the whole scheme of

selling is likely to require radical revision ere long. From the American viewpoint there is consolation in the thought that it is the foreign municipal plants that are doing the worrying just now. One solution of the difficulty which might work out well in the long run would be a fixed price per candle-power-year, including lamps, plus a direct meter rate on all energy used for whatever purpose. The effect of highly efficient lamps has never yet been destructive, and halving the present specific consumption would be really less of a shock than the plunge from 3.5 watts to 1.25 watts per candle already taken without disaster. The fact is that a change in the situation might actually prove a blessing in disguise by building up a huge miscellaneous electricity supply business now hardly imagined. Electricity supply ought to be a genuine household necessity instead of still standing out as somewhat of a luxury.

Convention of the International Association of Municipal Electricians

The annual convention of the International Association of Municipal Electricians was held at Watertown, N. Y., Aug. 19-22. The convention was representative of a new appreciation by members of their responsibilities for advance in electrical construction and for the adoption of uniform regulations by concerted action. Representatives of the National Fire Protection Association, National Electric Light Association, Western Association of Electrical Inspectors and the Bureau of Standards were present and took an active part in the discussions. By resolution the new work of the Bureau of Standards in investigating electrical life hazards was indorsed and assistance offered in gathering data and in making any regulations promulgated by the bureau effective. Dr. C. P. Steinmetz spoke quite fully on the proper standards from which electrical problems must now be viewed and how these problems were passing beyond the confines of cities and states. He suggested the possibility of federal regulation of construction and methods of operation. As consulting engineer for the city of Schenectady he was by acclamation made a member of the association.

Two Epochs of Rate Regulation

In a paper presented before the Michigan Section convention of the National Electric Light Association, held at Ottawa Beach, Mich., on Aug. 19-21, Mr. William J. Norton, secretary of the N. E. L. A. rate research committee, dealt with the two epochs of rate regulation, namely, the preparatory and the final.

After commenting upon the fact that ten new public service commissions have been established in 1913, the author stated that of the older commissions the really successful ones have considered that a period of preparatory regulation must be allowed, and that their main duty in this period consists in so making the orders that the public-service companies can adjust themselves to the new set of theoretical conditions which heretofore have not obtained. Mr. Norton remarked that the preparatory period will probably extend through the average life of the plant furnishing service, so that for the electric utilities one may consider that the preparatory epoch of regulation should last for from fifteen to twenty years.

In discussing valuation, the author claimed that a public service commission could well establish a joint valuation board which would have the confidence of both the commission and the companies. Such a board without any undue haste could begin to establish values throughout the state where such work was considered absolutely necessary or required by law. The men in charge of such valuation should be men of experience and integrity, and the bases of valuation should be carefully worked out.

Capitalization as it exists should be considered not as a crime committed by the company, but as a method of finance heretofore approved and often encouraged by the laws of the state. If there are any elements in the capitalization which cannot be approved in the future, the commission should provide means for the gradual amortization of such capitalization during the preparatory epoch of its regulation. Through it all there should be the greatest amount of co-operation between the companies and the commission. The advice of the ablest utility operators in the state should be frankly sought and considered by the commission in the effort to reach the second epoch of theoretical regulation as early as possible.

Concerning depreciation Mr. Norton said that it is always a most difficult matter to build up a depreciation fund, and both the public which is being served and the company are better off if a fund is too large rather than too small. Any minute discussion of the advantage of such theories as the sinking-fund basis or straight-line basis, etc., in the early preparatory epoch is entirely out of place, and the commission should direct that depreciation funds be built up just as fast and just as liberally as the rates will allow.

The modern theory of regulation demands that, as utilities are monopolies, the commercial basis should be discarded and a strict and definite rate of return should be established immediately. The municipalities generally, and the commissions sometimes, entirely neglect to consider that this means a complete reversal of the entire financial and executive policy of the company. If the newer policy is a good one and is to be maintained, commissions should again make such adjustment as would allow the companies in their financial transactions slowly but gradually to accommodate themselves to the stated rate of return. The public in the end is better served by liberality on this score, even if such liberality is only temporary, than it would be by a ruling so drastic that it would injure the financial stability of the company and make future extensions and development difficult.

Maximum or residence rates are generally reduced to a point which is determined either by force, through ordinances, or solely as a matter of policy. The large wholesale rates are again determined somewhat upon the additional cost of the service to the companies, but mainly upon the cost of supplying his own service by the individual user, and therefore the lowest rates are determined by a policy which is guided by a careful consideration of how much of the private-plant business the company wishes to obtain.

One might think that there would be some large retail business or some small wholesale business to which the pure cost-of-service theory might be applied, as this is profitable business and comes to the utility through its limited monopoly. As a rule, however, the company rate-makers are so busy in adjusting the schedule and making it logical between the low maximum rate and the low competitive rate that even in the center of the scale there is no room for the cost-of-service theory.

To careful observers the above condition shows that valuations and the rate of return are at best only approximate indications of what an electric rate should be, and that they should be used by a commission with a great deal of care in the regulation of electric rates.

The policy that has long been adopted by the executives of the companies is probably more efficient than any method based upon valuation. The usual policy has been carefully to study the balance sheets and the statistics of the growth of the business and to apply any surplus that is available at the point where it would accomplish most in acquiring new business or where it would relieve the most urgent stress. This has absolutely nothing to do with cost except in a most general sense, and more often it absolutely disregards cost for the sake of expediency. Utility execu-

tives have become experts in the application of rate reductions, and as a rule, while the different companies may not agree entirely as to method, the actual rate curves of most of the companies throughout the country are theoretically sound. That they are practical and effectual is evidenced by the rapid growth in the business.

Mr. Norton expressed the belief that commissions should at the very beginning of their administrations assume that they have before them an epoch of from ten to twenty years which can best be used by them in assisting in adjustments to be made by the companies themselves in preparation for a second or final period of regulation in which pure theory may be applied, without harm either to the public or the companies. Such a position will produce early in their administrations a spirit of co-operation on the part of the companies and eventually with the public which will do a great deal more to accomplish the desired result than any drastic or bitter regulation could ever accomplish. He argued that it is a very poor policy indeed for a company to wait until the public or a commission forces it to do things it should have done on its own initiative. In such matters as the form of schedules and uniform accounts the commission can greatly help the entire situation, but in the matter of the publicity of rate schedules, in the adoption of a proper method providing for depreciation, or in a study of rate forms, and in the actual making of rate adjustments or reductions, an energetic and up-to-date company should act in advance of any suggestion or command from the commission.

Convention of Michigan Section, N. E. L. A.

The second annual convention of the Michigan Section of the National Electric Light Association was held at Ottawa Beach, Mich., Aug. 19, 20 and 21, marking also the seventh annual meeting of the original state organization. Sessions were held at the Ottawa Beach Hotel, the program for the half-day meetings including ten papers and five addresses. Of the total convention attendance, numbering 132, twenty were ladies.

President F. B. Drees, Lansing, opened the first session with an address pointing out the better relationships between public and corporations which have resulted from the work of the N. E. L. A. and its sections. Formerly a corporation was a mystery. Mystery spelled distrust, distrust spelled antagonism, and antagonism meant failure. But now, he commented, utility corporations work hand in hand with employees and public. In closing, the president suggested that committees be appointed on the subjects of public policy and the installation of lightning arresters.

Indirect and Semi-Indirect Lighting

In the absence of Mr. James R. Cravath, consulting engineer, Chicago, his paper, "The Practical Application of Indirect and Semi-Direct Lighting," was read by Secretary Herbert Silvester, Detroit. The author predicted that there will be no decline in the use of indirect lighting as long as light is obtainable only from intensely concentrated sources. Three reasons were given for the increasing use of the indirect system: (1) Avoidance of uncomfortable and injurious glare from the lamps themselves; (2) reduction in annoying glare of specular reflection from paper; (3) elimination of sharp shadows. While a given average illumination can be obtained by direct lighting with 60 per cent of the energy consumed by the most efficient indirect system, the human efficiency and comfort which are obtained with the latter nevertheless more than counterbalance the reduced lighting efficiency. Advantages of semi-indirect lighting over direct lighting were brought out, and attention was called to the effect of the shape of the translucent bowl, its composition and interior finish on the efficiency of such a system. From tests it has been found that when more than 15 per cent of the light received on a book comes directly from the translucent bowl of a semi-indirect fixture the shadows become annoying. To get satisfactory results from semi-indirect lighting the use of several scattered units was advised as being preferable to concentrated lighting.

Handling Customers' Complaints

Mr. D. B. South, Detroit, next read a paper on "The American Kicker," which discussed methods of holding business already secured and described the procedure followed by the Edison Illuminating Company of Detroit to satisfy a customer that his meter is recording correctly. Methods of tabulating complaints and inspection reports were also outlined. The number of complaints received by this company in 1912 was less than 2 per cent of the customers on its lines. Of these only 18 per cent had reasonable justification. Investigating these complaints and clearing up the trouble cost approximately $2.70 each on the average. Of the total sum expended over 70 per cent went for investigating complaints which had no substantial backing. The latter expenditure was warranted, however, by the good-will obtained. The cost per capita amounted to 5 cents, and the cost per bill rendered amounted to 0.4 cent. Similar figures were given on the complaints received by telephone and letter. The author also discussed methods of adjusting customers' bills affected by grounded circuits.

Discussion

The contents of the paper aroused an interesting discussion on the part of Messrs. H. C. Sterling, Three Rivers; E. A. Lucky, Detroit; H. A. Fee, Adrian; F. B. Drees, Lansing; R. W. Hemphill, Ann Arbor; T. L. Hinks, Detroit, and F. C. Vieson, Detroit.

Mr. Sterling said that complainants always like to talk the matter over with someone. He therefore makes it a point to receive them in his office a few days each month rather than have them argue with the cashier.

Mr. South declared that inspectors should also visit customers who don't complain, ascertaining whether the service is satisfactory and thus helping to hold the good-will of the people.

Mr. Fee said that the Citizens' Light & Power Company, of Adrian, maintains an inspector who in his spare moments repairs flatirons, etc., and solicits new business.

Mr. Hemphill emphasized the fact that an aggressive complainer is a very desirable customer if he can be won over to the company's side, as he will then be just as aggressive in boosting the company. Mr. Hemphill also employs an investigator who keeps the company in personal touch with its customers.

Mr. Hinks advised having an inspector to investigate complaints, leaving the office, if necessary, to settle the affair with the customer diplomatically.

Mr. Fee told of sending out circulars asking for suggestions for improving the company's service. Prizes such as electric flatirons and energy-consuming devices were awarded for the best replies.

Contractor and Central Station

Mr. C. J. Litscher, of Grand Rapids, read a paper on "The Relation of the Central Station to the Electrical Contractor," which was in general similar to that delivered at the Electrical Jobbers' Association convention held in Chicago several months ago. The paper dealt with the subject of central-station companies merchandising electrical appliances at a value below that at which contractors and supply dealers could furnish them.

Staff Co-operation

Mr. Thomas Chandler, of Sault Ste. Marie, read a paper entitled "The Chain," likening the various departments of a central-station company to the links and showing how

important each one is to the strength of the company's business. The appearance of the meter reader and the impression he leaves behind him as a representative of the company were also dwelt upon forcibly. In clearing up complaints the troublemen must make a good impression both as to personality and as to ability to do the work assigned to them. Rendering bills to customers is another link in the chain. When one monthly meter reading has been omitted, the author advised stamping on the next statement "Two months' bill," to attract the customers attention to the fact that the previous month's bill was not paid. In addition he advised sending a blank statement stamped "Meter not read this month."

Messrs. Silvester, Hinks, Sterling, Fee, South, Hemphill, Drees and Eugene Holcomb, Lansing, took part in the discussion which followed.

Mr. Sterling advised rendering a minimum bill even when the meter is not read, later deducting this amount from the second bill. His suggestion did not, however, meet with much favor.

Mr. Fee told of the use of blank-dial post cards at Adrian. Mr. Hemphill favored mailing bills instead of delivering them.

Mr. Silvester reported that the Edison Illuminating Company of Detroit delivers its bills at a cost of $0.5 cent each, which is cheaper than mailing them.

Secretary Martin's Address

The Wednesday morning session was opened with an address by Mr. T. C. Martin, secretary of the N. E. L. A., who mentioned the difficulties experienced in holding the large national conventions. Several solutions have been suggested—one to divide the association into group associations, such as the New England Section and Southeastern Section, and hold meetings at different times. Another might be to have the accounting, commercial and technical sections held at different times of the year.

Rates and Accounting

Mr. William J. Norton, Chicago, delivered a paper on "The Two Epochs of Rate Regulation," an abstract of which appears elsewhere in this issue.

Mr. Fred L. Dennis, of South Bend, Ind., gave a talk on the formation and work of the committee on uniform accounting. The N. E. L. A. classifications were boiled down to meet the requirements of the Michigan Railroad Commission, retaining only the essentials. Forms devised for the reports were also made so to give direct comparison between large and small companies.

Franchise Matters

Mr. James V. Oxtoby, of Detroit, gave an interesting talk on the subject "Public Utilities as Affected by the New Michigan Constitution." In general his address was similar to that he gave at the Ohio convention, July 17, a brief report of which was given in the *Electrical World* of Aug. 2. Topics having special application to Michigan were, of course, added, including the subject of franchises and home rule.

The Hon. Lawton T. Hemans, of Lansing, chairman of the Michigan Railroad Commission, spoke on the position of the commission as a medium between public and corporation. His talk dealt with the value of commissions as clearing houses for grievances. "Individuals who are versed in all phases of engineering are hard to obtain, so the commissioners can do the next best thing, and that is to use 'horse sense,'" said Mr. Hemans.

The closing session of Thursday was opened by Professor Sawyer, of the electrical department of Michigan Agricultural College. Formerly his duties were in educating agricultural students in the use of electricity. Now the aim is to get central-station men to supply the farmers. Just as the public are dependent on farmers for food supplies, so should the farmers, he said, be dependent on electricity.

Accident Prevention

Mr. R. L. Drake, secretary of the Industrial Accident Board, spoke of the influence which the new compensation law has had on accident prevention. Before it was enforced there were on an average two fatal and 100 nonserious accidents in Michigan every day. Since the passage of the law the accidents have been reduced to an average of one and one-half fatal and sixty-five nonserious accidents a day.

In the discussion Messrs. Sterling, Fee, Hamphill and Vieson took part.

Grounded One-Wire Distribution System

"High Tension Distribution by Means of a One-Wire Grounded System" was the subject of the paper read by Mr. J. A. Cavanaugh, of Benton Harbor, who told how a single-phase transmission line 2.5 miles long was built on telephone poles with one side grounded. The possibility of accidental grounds between various parts of the system was avoided by using 1:1 or 1:2 transformers. The primary circuit is fused to ground but the secondaries are not grounded. The total cost of line construction amounted to $228.65, including labor and material. According to the author of this paper, the same line constructed with two wires instead of one would have cost $151.65 more per mile.

A description of an automatic pumping station at Farmington, Mich., was given by Mr. A. R. Cary, of Rochester, Mich., and accompanied by pictures. Forty-eight consumers are now supplied, the minimum charge being $1.50 per quarter, allowing the use of 9000 gal.

Street Lighting

Mr. D. W. Hayes, of Ann Arbor, read a paper describing "The Series Luminous-Arc Rectifier System of Ann Arbor, Mich.," where 181 direct-current magnetite-arc lamps and 159 tungsten street lamps are operated. The methods of supporting, cleaning and repairing lamps and rehabilitating rectifier tubes were also described.

Mr. F. R. Mistersky, superintendent of public lighting, Detroit, related his experience with a similar system, where 6400 arcs are installed, 4000 of which are the luminous type. Although guaranteed for only 500 hours, some of the rectifier tubes have lasted as long as 12,000 hours, with an average life of 3500 hours. When the tubes begin to deteriorate they are washed and baked at a temperature of 80 deg Fahr., prolonging their life for additional service.

The last paper on the program, entitled "Alternating-Current Motors and Their Efficient Operation," was read by Mr. W. J. Fitzgerald, Detroit.

Various types of single-phase and polyphase motors were described, with their advantages and disadvantages. Mr. Fitzgerald advised the use of high-speed motors in every case. A few suggestions were also given on belting, line shafting and lubrication.

Election of Officers

At the executive session the following officers were elected: President, Mr. H. C. Sterling, Three Rivers; vice-president, Mr. H. A. Fee, Adrian, and secretary, Mr. Herbert Silvester, Detroit. Mr. Sterling is the manager of the Constantine Hydraulic Company at Three Rivers. The executive committee which was appointed is as follows: Mr. William Chandler, Sault Ste. Marie; Mr. R. E. Richardson, Kalamazoo; Mr. J. A. Cavanaugh, Benton Harbor; Mr. J. E. Stanton, Belding, and Mr. R. W. Hamphill, Jr., Ann Arbor.

On Wednesday evening a rejuvenation of the Jovian Order was held at which twenty-three candidates were initiated. Messrs. H. A. Roseberry and W. J. Trott, statesmen, were in charge of the ceremonies.

Public Service Commission News

WISCONSIN COMMISSION

The Railroad Commission of Wisconsin has issued a revised set of rules and regulations relative to the standard of gas and electric service to supersede the rules established on July 24, 1908. The order follows a public hearing given by the commission at Milwaukee on April 22, 1913. The revised rules were prepared by the engineers of the commission after a study which covered the period of five years since the original order was issued. Without materially changing the standards themselves, the revised rules define somewhat differently the practices required of the utilities in order to maintain those standards.

In the rules for gas service the chief changes have been made in the rules for testing meters and the maintenance of meter-test records. In the matter of periodic tests the revised rules require that each meter shall be tested and overhauled once in four years, instead of once in three years as has been the custom, and that at least two consecutive test runs which agree within 0.5 per cent must be made. The records of meter tests are to be kept more carefully and complete information concerning every meter must be available at any time. The original standards of heating value are to be retained, but the gas utilities are required to determine the heat value of gas on at least three days of each week instead of periodically as formerly. The rule covering gas-pressure variation has been revised so as to make the minimum gas pressure at the consumer's outlet 2 in. instead of 1.5 in. of water pressure. The maximum must not exceed 6 in., as heretofore, and must not be greater than twice the minimum pressure. The rule requiring the utilities to submit monthly summaries of complaints is abandoned but such records must still be kept.

A number of modifications are made in the rules regarding electric service. The rule which limits the error of any meter to 4 per cent on light load, half load or full load has been changed to include any load between one-tenth and full load. No attempt was made to define average accuracy of watt-hour meters, since it was recognized that this varies with conditions to such an extent that it is better practice to take this into account in adjusting bills for incorrect meters. Instead of merely requiring each meter to be tested and adjusted for accuracy at the time of its installation, the new rule provides that "each watt-hour meter shall be checked for current connection, mechanical conditions, suitable location and accuracy of measurement at approximately three-quarters and one-tenth connected load by comparing the meter with approved standards in its permanent position in place of service within thirty days after installation. Meters operating at low power-factor shall also be tested at approximately the minimum power-factor under which they will be required to operate. Meters installed with instrument transformers or shunts must be tested jointly with the transformers or shunts, otherwise the transformation of the transformers or calibration of the shunts must be determined at least once every five years." The rule providing for the testing of each meter at least once a year has been abandoned, and henceforth all meters requiring periodic tests must be tested according to the following schedule and under the conditions prescribed above:

"Single-phase induction-type meters having current capacities not exceeding 50 amp shall be tested at least once every two years and as much oftener as the results obtained shall warrant.

"All single-phase induction-type meters having current capacities exceeding 50 amp and all polyphase and commutator-type meters having voltage ratings not exceeding 250 volts and current capacities not exceeding 50 amp shall be tested at least once every year.

"All other watt-hour meters shall be tested at least once every six months.

"In no case shall commutator-type meters having heavy moving elements and sapphire jewels be allowed to make more than 1,000,000 revolutions between tests. Where meters are found to register considerably in error when tested on the above schedule the commission reserves the right to order the particular meter or class of meters tested more frequently."

Each electric utility is required to own suitable working standards for the testing of meters and these standards must be correct within 0.5 per cent or proper corrections applied.

Considerable difficulty has been experienced by the commission in the past owing to the absence of complete station records, and the following new rule has been added: "Each utility furnishing electric service shall keep a record of the time of starting and shutting down power-station equipment and feeders, together with the indication of the principal switchboard instruments at sufficiently frequent intervals to show the characteristics of the load, and shall maintain a record of all interruptions of service upon the entire system or major divisions of its system and include in such record time, duration and cause of each interruption." An interruption is defined as a period of over thirty seconds during which the voltage on the circuit is less than 80 per cent of its normal value.

The old rule covering the pressure variation has been left intact in so far as it applies to utilities operating in cities of less than 1500 population. In cities of over 1500 the new rules provide that the utilities shall adopt a standard voltage for the entire constant potential system and shall maintain the voltage within 3 per cent of such standard on all lighting circuits during lighting hours; on motor circuits and during other than lighting hours the voltage shall be maintained within 10 per cent of the standard. To insure compliance with the above rule without the necessity on the part of the commission's staff of making practically all the voltage surveys, a rule has been added which requires all utilities to make a sufficient number of voltage surveys to indicate the service furnished from each transformer and feeder. Utilities serving more than 250 consumers are required to own and to keep in constant service at least one portable graphic recording voltmeter.

All the other rules are essentially the same as before. The question of maximum demand received attention, but it was felt that the development of meters and instruments for determining maximum demand is in such a state that definite rules governing the determination of maximum demand and the testing of demand-indicating apparatus should not be included in the present order. The commission reserves the right, however, to add rules covering the matter whenever such addition shall appear advisable.

The revised rules and regulations will go into effect on Oct. 9.

CALIFORNIA COMMISSION

The California Railroad Commission has authorized the Pacific Gas & Electric Company to execute a general-lien mortgage to the Guaranty Trust Company of New York and William C. Cox, and to issue thereunder $5,000,000 face value of ten-year 6 per cent convertible bonds. Permission is given to exchange these bonds for stock issued at 80. Moreover, the company is authorized to issue demand notes to the amount of $4,500,000, the collateral being $5,000,000 thirty-year 5 per cent general and refunding mortgage bonds.

The California Railroad Commission has issued an order permitting the renewal of notes issued by public-utility corporations for not more than a twelve-month period, without formal application for such renewal to the commission; but no such notes may be re-funded by stocks, bonds, notes or evidences of indebtedness, without the consent of the commission.

Current News Notes

Ohio Public Utilities Commission.—Governor Cox of Ohio has appointed as members of the Public Utilities Commission Messrs. O. H. Hughes, W. L. Dechant and E. L. Doty. Mr. Hughes was a member of the former commission, which on Aug. 8 was dissolved, the present commission succeeding it.

* * *

Outing of Doherty Employees.—H. L. Doherty & Company, well-known bankers and public utility operators of New York, held an outing at the Terra Marine Inn on Aug. 16. The day was given over entirely to water sports, field sports and numerous games and ended with a dinner in the evening followed by the presentation of prizes, a few speeches and dancing.

* * *

English 25,000-Kw Unit for Fisk Street Station.—The 25,000-kw horizontal Parsons turbo-generator designed for the extension of the Fisk Street station of the Commonwealth Edison Company of Chicago is being shipped from the works of C. A. Parsons & Company, Newcastle-on-Tyne, England. This is the largest electrical generating unit yet completed, but it will be some time before it is erected and in operation.

* * *

Radio Institute Formed.—The Institute of Radio Engineers, Inc., filed organization papers in Albany on Aug. 23 under the membership corporation law. The object of the society is to advance the art and science of radio transmission and to publish works of literature, science and art for such purposes. The incorporators are Messrs. R. H. Marriott, Lloyd Espenschied, A. N. Goldsmith, J. Stone, E. Simon, R. A. Weagant, G. W. Pichard, J. H. Hammond, Jr., and J. L. Hogan, Jr.

* * *

City Buys Power Site.—To provide cheap electrical energy for its industries, the city of Spooner, Wis., has bought 40 acres of land 9 miles below the city on the Namekagen River. There is one of the best remaining sources of water-power that are undeveloped in Wisconsin, and the purpose of the city officials is to supply energy at cost from a proposed plant at that point to manufacturers locating in Spooner. The city already owns a municipal electric light plant on the Yellow River.

* * *

Jovian Day at Rivercliff-on-the-Sound.—On Jovian Day, Sept. 6, 1913, the Jovians of New England will hold a rejuvenation, shore dinner and field day at Rivercliff-on-the-Sound, Conn. Special cars will leave Bridgeport at 12:30 p. m. for Rivercliff. Mr. Frank E. Watts, reigning Jupiter of the Jovian Order, and Hon. Clifford B. Wilson, Mayor of the city of Bridgeport, will be among the guests of honor. The Jovian degree will be conferred by the members of the Bridgeport team.

* * *

Development Work to Begin at Sault Ste. Marie.—The Edison-Sault Electric Company has been informed by the Secretary of War that its application for the construction of an addition to its power house and for the installation of additional generating machinery has been approved. The company has been instructed to proceed with the work and will make an addition 58 ft. long and considerably wider than the present structure to its power house. The plans provide for the installation of two additional generating units and one exciter unit.

* * *

Election of Officers of the Schenectady Section, A. I. E. E.—At a recent meeting of the Schenectady Section of the American Institute of Electrical Engineers the following officers were elected: Honorary chairman, Dr. C. P. Steinmetz; chairman, Mr. George H. Hill; vice-chairmen, for two years, Messrs. H. M. Hobart, C. E. Eveleth and A. H. Kreusi; managers for two years, Messrs. J. A. Dewhurst, W. L. Upson, W. L. Merrill and H. P. Broderson. Mr. John R. Hewett is secretary of the section, and Mr. A. I. Sundheimer is treasurer.

* * *

Omaha Electric Light & Power Company Wins Suit.—The United States Supreme Court has decided against the city of Omaha in its suit against the Omaha Electric Light & Power Company to prevent the latter from selling electricity in Omaha. The company's charter expired in 1894 and the city contended that the company thereby lost its lighting franchise. The Supreme Court decided that the Omaha Electric Light & Power Company has by accepting the terms of the City Council in 1884 and living up to them gained a perpetual franchise. There is some talk of starting a municipal plant from the profits derived from the municipal water-works.

* * *

Studies of Atmospheric Electricity.—The study of atmospheric electricity is carried on much more actively in Germany than in any other country. A joint commission on this subject has been established by several German academies of science, and the recently published report of its Munich meeting constitutes a document of much interest to physicists and meteorologists as an example of the latest views and theories of experts in this somewhat neglected and highly specialized field of science. The report is entitled "Protokoll der Sitzungen der luftelektrischen Kommission der kartellierten deutschen Akademien zu München" and is published by the Bavarian Academy of Science.

* * *

Opening for Assistant Electric Railroad Inspector.—The State Civil Service Commission, Albany, N. Y., will hold examinations on Sept. 13 for an assistant electric railroad inspector for the Public Service Commission of the Second District. The position, which has a salary of $1,500 per annum attached to it, requires ability to pass judgment on the construction, equipment and operation of electric roads, including the examination of tracks and roadbeds, structures on electric railroads, examination of cars and equipment, investigation of methods of operation and efficiency of service, and examination into the efficiency and reliability of energy supply for maximum requirements of operation. No written examination will be held and applicants will be rated solely from the statements of experience in training found in the application form and from such other information as the commission may obtain regarding them.

* * *

Automobiles in Perry Victory Parade.—About 300 passenger and commercial vehicles constituted the automobile parade given as a part of the Oliver Hazard Perry victory celebration in Chicago on Aug. 23. For the best decorated electric passenger car a first prize of $100 was awarded to the Anderson Electric Car Company, of Detroit, and the second prize, $75, to the Chicago Electric Motor Car Company. Similar prizes for the best decorated trucks were awarded to the Commonwealth Edison Company and the Firestone Tire & Rubber Company. The American Express Company received a trophy valued at $85 for the greatest number of entries from one firm, it having forty-five vehicles in line. The trophy for the dealer having the greatest number of electric cars of one make went to the Anderson Electric Car Company, of Detroit. The trophy for the concern having the greatest number of trucks of one make went to the Baker Motor Vehicle Company, of Cleveland. About 120 of the automobiles in the parade were electric vehicles.

Combination Railway and Lighting System

Description of the Gorge steam station of the Northern Ohio Traction & Light Company, of Akron, Ohio, at Cuyahoga Falls. By J. C. Lathrop

CHIEF among the numerous improvements now being made by the Northern Ohio Traction & Light Company, of Akron, Ohio, is the system for the generation and distribution of electrical energy. This includes a steam station, known as the Gorge power station, with a present rating of 30,000 kw and an ultimate rating of 50,000 kw, a hydraulic station of 2000-kw rating, eight substations and the necessary transmission lines.

The company owns and operates approximately 216 miles of single track, consisting of the city lines in Akron and Canton and the interurban lines from Akron north to Cleveland, south to Canton, Massillon, Urichsville, Canal Dover, etc., east to Kent and Ravenna, and southwest to Barberton and Wadsworth. In addition, it supplies electricity for all services in the city of Akron and numerous towns and villages on the railway lines. The latter business has developed more rapidly during the past few years than the company's facilities for handling it, and in several instances proffered business has necessarily been refused. The gross receipts of the company during 1912 exceeded those of 1911 by 11.2 per cent.

The territory through which the company's suburban lines pass is one teeming with manufactures—in fact, a veritable beehive of industry. The road has as its northern terminal Cleveland, which is the sixth city in the United States in population. Cleveland alone has an extremely diversified line of manufacture, including steel mills, brick works, oil refineries, etc. As stated before, this company owns all the city lines in Akron, which is noted for its rubber works and the manufacture of cereal and clay products. Two other cities on its lines which are of considerable commercial importance are Canton and Barberton.

Existing Generating Stations

At the present time electrical energy is generated in power stations at Canton, Akron, Silver Lake Junction and Bedford. The existing Canton power station has a rating of about 3300 boiler-hp and carries little but the railway load, as the central-station service in the city of Canton is controlled by another company.

The Beech Street power station in Akron, with 5400 boiler-hp, generates alternating current for lighting and industrial service in the city of Akron at 1080 volts, which is transmitted at the same voltage and stepped down to the proper voltage for service use by pole-type transformers. This station also furnishes energy to three motor-generators in the turbine room, which deliver direct-current energy to the railway feeders, and 22,000-volt alternating-current energy, which feeds the substation at Barberton. The power station at Silver Lake Junction, with 1750 boiler-hp, and that at Bedford, with 1000 boiler-hp, generate 600-volt direct current only, for the railway lines.

The Gorge power station, supplemented by the hydraulic station, will replace the stations at Akron, Silver Lake Junction and Bedford and furnish all energy required north of Canton, and the existing station at Canton, generating alternating current at 25 cycles, will supply the city lines in Canton and the interurban lines south of Canton.

The reason the latter station has been retained in service is because it is the most modern and economical of all of the existing stations and also was specifically described in one of the mortgages on subsidiary properties and more or less trouble was anticipated if dismantling was attempted. Also in order to change the system be-

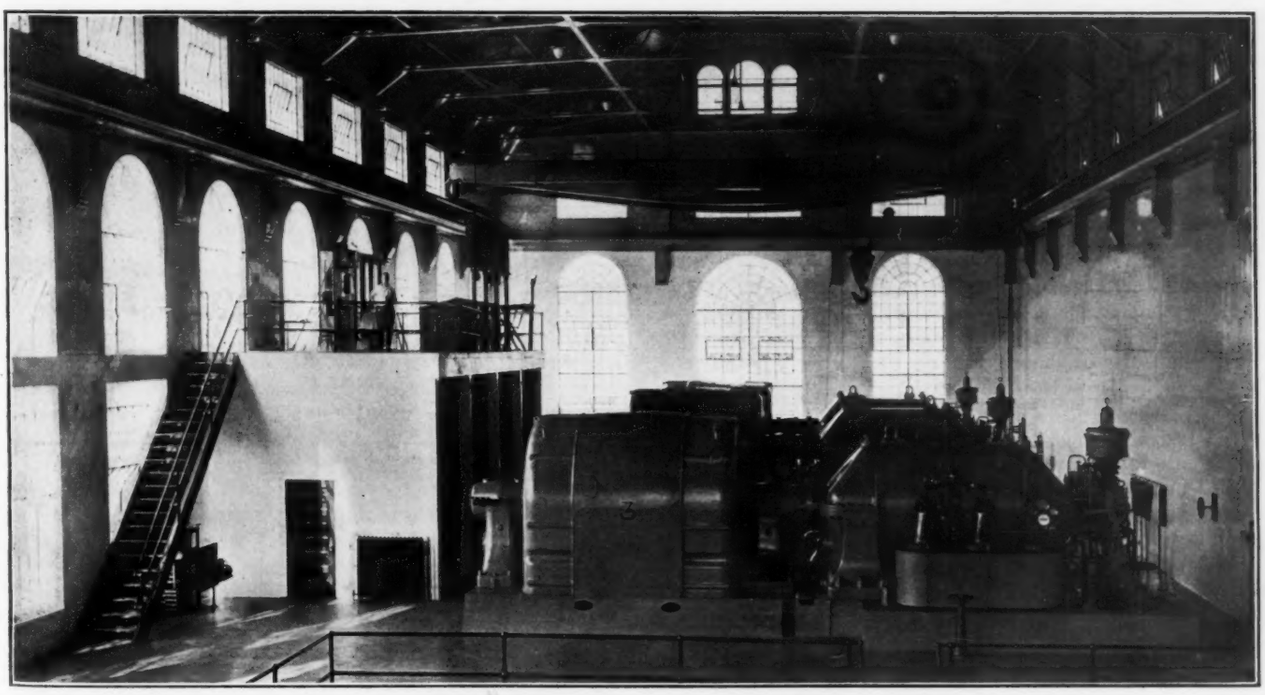


FIG. 1—GENERATOR ROOM, GORGE STATION OF THE NORTHERN OHIO TRACTION & LIGHT COMPANY

low Canton to 60-cycle operation it would be necessary to scrap a large quantity of 25-cycle machinery. Furthermore, the losses in transmission from the Gorge power station would be greater, and it was therefore decided that it would be advantageous to continue the operation of this station for the present.

The Bedford and Silver Lake power stations will be replaced by substations No. 1 at Bedford, No. 2 at Northfield, No. 3 in the Gorge power station, No. 5 at Kent and the necessary high-tension lines feeding these substations from the Gorge power station. The Beech Street power house at Akron will be replaced by Substation No. 4, which will receive current from the Gorge power station at 22,000 volts, which will be transformed in this station for lamp, motor and railway loads. This station will also be a switching station for high-tension lines which will feed the Barberton substation and Substations A and B between Akron and Canton, which are now fed from the Canton power station.

been used for some years as a pleasure resort. The pond formed by the dam will add considerably to the beauties of this spot and should increase the revenues of the company.

The coal for this station will be delivered over the Pennsylvania Railroad, the only railroad which runs near the site. The company has a siding from this road which runs along the top of the bank at an elevation about 90 ft. above the boiler-room floor. A trestle with coal bunkers underneath is now nearing completion on which loaded cars will be shifted by the company's motor car. From the bunkers the coal will pass through valves into the crusher car and through this crusher car into individual bunkers for each boiler. In passing from these small bunkers to the stokers the coal will pass through Richardson automatic scales so that a fairly accurate record of the amount of coal that is delivered to each boiler will be kept.

The station structure was designed with sufficient ca-

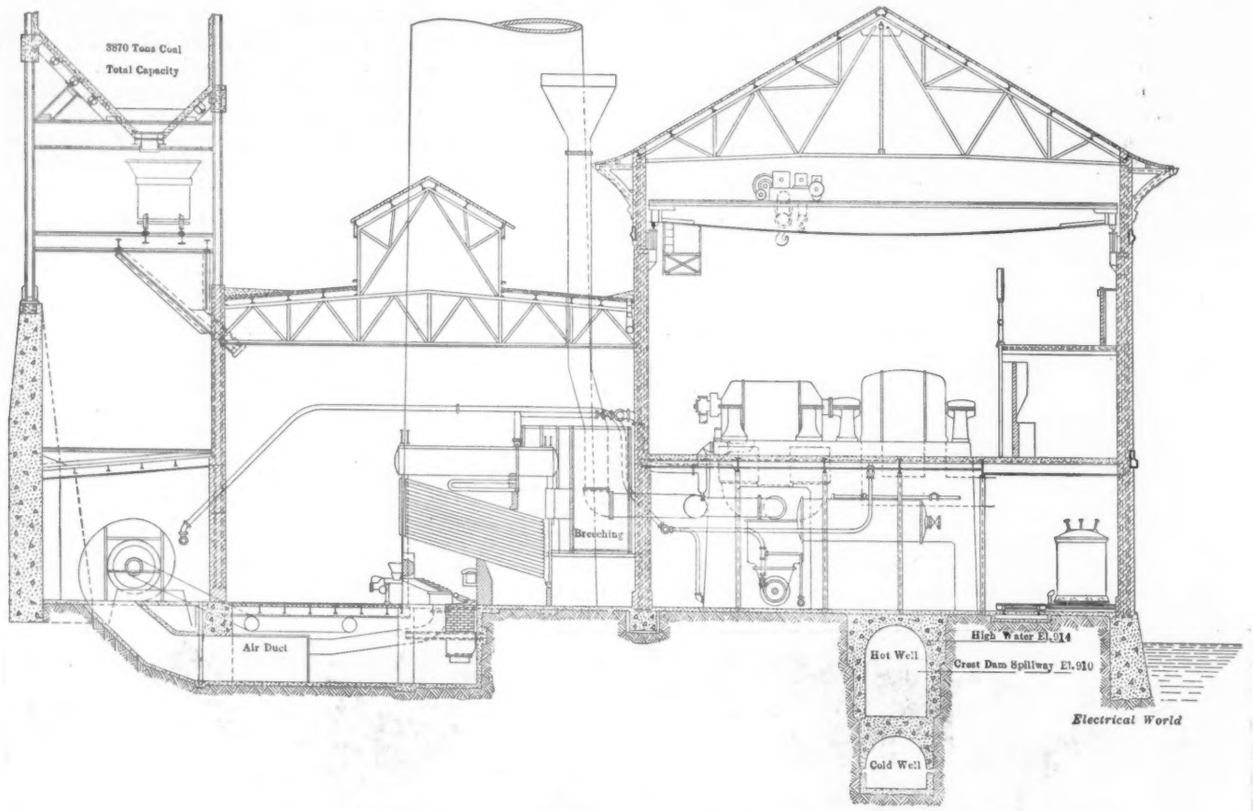


FIG. 2—SECTIONAL ELEVATION OF GORGE STATION OF NORTHERN OHIO TRACTION & LIGHT COMPANY

This article will be confined to a description of the structure and equipment of the Gorge power station, which is nearly completed and has taken on a portion of the load. The station is located in the valley of the Cuyahoga River, just below the Cuyahoga Falls, Ohio.

Description of Gorge Station

As the low-water flow of the Cuyahoga River was not sufficient for condensing purposes, it was necessary to build a dam so that a suitable pond for cooling water would be provided, and as the fall of the Cuyahoga River is quite rapid at this point, it was found possible by utilizing the head from this dam in connection with a fall below the dam, to secure a head of about 100 ft. one-half mile below the dam.

Other reasons for adopting this site were the convenient and permanent location and the fact that the property was owned by the company. The natural scenery in this vicinity is very beautiful and the company's property has

pacity to care for future requirements of the system, and additional machinery will be installed from time to time as may be found necessary. The power station proper consists of the boiler room, 56 ft. wide by 330 ft. long, and the turbine room, 63 ft. wide by 227 ft. long, separated by a division wall, the turbine room being on the river side. The turbine room was located on this side because this decreased the length of the condensing water tunnels and also simplified the delivery of coal to the boiler room. In addition, there are two small wings in one of which are the blowers for the forced draft and in the other the lightning arresters. In case this station is enlarged at any future time it will be extended in a westerly direction, but the probabilities are that when the load increases to that extent an entirely new station will be built in some other location.

The main floor of the boiler room, which is flush with the basement of the turbine room, is placed at elevation 918.5, which is about 40 ft. above the bed of the stream

and about 90 ft. below the top of the bluff, where coal is to be delivered. The dam, which is about half a mile below this station, has its spillway at elevation 910, so that low water would only be 8 ft. 6 in. below the turbine-room basement. These elevations are referred to sea level. During the recent floods in Ohio the water rose to elevation 918.2. Flash-boards may be provided on the spillway so that the low-water elevation will be 912.

The foundations for the building are of concrete, on solid rock, or of a compact shale which is found along the banks of the river and which is very durable when protected from the weather. It was necessary to construct a massive concrete wall about 24 ft. high on the river side to obtain this solid rock foundation, but as the rock slope was very steep, the remaining foundation walls for the building were only 2 ft. 6 in. deep, except where they stepped up at the ends of the turbine room.

The intake tunnel was built under this wall at the west end of the building, and a concrete wall was built adjoining this foundation wall directly over the intake, with an open space 1 ft. wide arranged for a shut-off gate in case at any time it should be necessary to clean the intake tunnel. A trench for the intake and discharge tunnel for condensing water was cut in this rock and the tunnels were built of concrete, the discharge tunnel being directly above the intake.

A screen well was built in the end of the transformer room and duplicate sets of screens were provided, so arranged that they can be hoisted to the transformer-room floor for cleaning.

The suction lines for the condensers reach the intake tunnels through wells located at the side of the tunnels. A channeling machine similar to those used in stone quarries was used in cutting the sides of this trench, the rock between the channels being blasted. This machine proved very efficient on this work and fully paid for itself on this job alone.

The general design of the exterior of this building is shown in the accompanying photographs. As this structure is in a prominent location where thousands of the patrons of the road pass each day, an attempt was made to insure a pleasing exterior. The walls are built of paving block, the exterior face being laid in Flemish bond of No. 1 cherry-red blocks with ½-in. raked joints and black mortar, backed with No. 2 blocks. All trimmings, moldings, window architraves, copings, etc., were furnished in gray architectural terra cotta having a tooled surface. The window sashes are of solid steel sections throughout, furnished by the Detroit Steel Products Company. Those in the turbine room are glazed with polished plate glass, while all others are glazed with AA double-strength glass. The monitors over the boiler room are provided with continuous steel sash, glazed with ribbed wire glass. These sashes swing from the top and are opened or closed in sections by devices operated from the boiler-room floor. A steel rolling door has been provided in the center of the turbine-room basement. This door is large enough to allow standard railway cars to enter, and the cars can be brought to a point under a main hatchway in the turbine-room floor, so that material can be unloaded by the traveling crane.

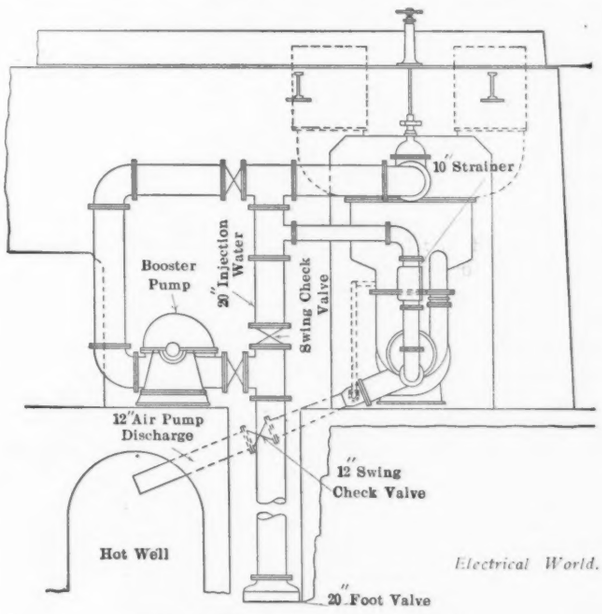


FIG. 3—CONDENSER CONNECTIONS

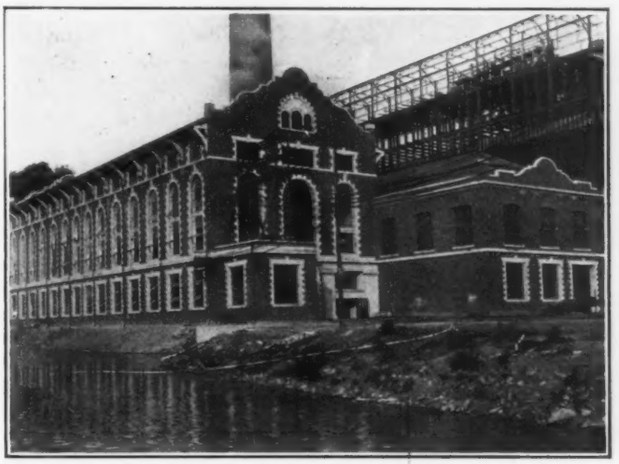


FIG. 4—EXTERIOR OF GORGE STATION

The main entrance to the building is just to the right of this track entrance. At one side is the timekeeper's office, and all the men are supposed to check in and out at this point, a door between the turbine-room basement and boiler room having been provided. On this basement floor are provided toilet and locker rooms for the firemen, together with shower baths, etc. The engineer's office is located in the corner of the turbine room, directly above this entrance, and a mezzanine floor is directly under this office, on which are the toilet and locker rooms for the operating forces in the turbine room.

All plumbing and fixtures throughout are of the best grade. Drinking fountains, to which is piped spring water from the bluff, are provided at various points throughout the station, as the general service water is taken directly from the river and is not fit for drinking purposes on account of the discharges from factories, etc., just above.

The roof of the engineer's office is made of 6-in. by 6-in. skylight glass, with sufficient strength to permit of its use as a visitors' gallery. To this end an ornamental railing around the edge of the roof and a stairway from the engineer's office is provided.

The entire surface of the turbine-room walls under the crane runway girders is finished with a marble-like material, known as "Vitrolite," and all interior ironwork is painted a light gray. All floors in the turbine room have a granulithic finish. Lamp circuits are carried in conduits back of the wall facing, except above the crane runways.

A switchboard gallery about 40 ft. long is located in the center of the turbine room on the river side. The structural steel framing is independent of the walls and was erected complete before the general building construction was started. I-shaped plate and angle columns were used throughout. Roof trusses of the "Fink" type were used over the turbine room and ordinary flat-top trusses over the boiler room. The crane runway girders

consist of built-up sections, reinforced in a lateral direction by 15-in. channels on the top flange. The traveling crane was operated for several weeks before the side walls and roof were built, and the rigidity of the steel construction was shown by the entire absence of vibration while the crane was in motion.

The roof of the turbine room is of Spanish tile laid on a reinforced-concrete slab, tile being used mainly for the architectural effect. The monitors on the boiler room are covered with the same tile, while the general surface of the boiler-room roof has a standard tar and gravel surface over concrete.

Boiler-Room Equipment

The boiler room contains sixteen 604-hp Babcock & Wilcox boilers and superheaters, eight of which are in service at this time. These boilers are arranged in a single row, the stack being placed in the center of the boiler room, with eight boilers on one side and eight on the other. All boilers are equipped with Taylor stokers. Sturtevant fans, driven by Sturtevant engines, which are located in the blower room, just south of the boiler room, furnish the forced draft for these stokers.

Engines were chosen to drive the fans instead of motors so that it would be possible to regulate the speed of the fans directly from the steam pressure. The stoker contractors guarantee that the steam pressure will be held within 5 lb. of the desired working pressure when the boilers are normally operated at not over 200 per cent of rated capacity.

Ducts in the basement of the boiler room carry the air for the forced draft. The driving shafts for the stokers, which are driven by the same engines that drive the blowers, are also in the basement. The stokers are fed through chutes from small bunkers mentioned in a previous paragraph.

The ashes are dumped into ash pockets underneath the grates. The ash pockets are provided with dumping grates so that a carload can be dumped at one time. For the present the ashes are wheeled out by hand, but an elevator will soon be installed at the end of the boiler room so that the small cars can be lifted from the basement level to a trestle of sufficient height and thence be dumped into wagons or standard railroad cars for removal.

Steam at a pressure of 200 lb. will be used with a superheat from 75 deg. to 90 deg. Each boiler will be equipped with recording instruments in order that a complete comparative record of coal consumption and steam furnished may be kept. Richardson 200-lb. automatic scales have been ordered for each boiler. Each boiler will also be provided with a CO_2 recorder, draft gage and steam-flow meter. Recording thermometers will be used throughout so that an exact record of conditions may be kept. Automatic feed-water regulators were installed on all boilers.

The stack was built by the Alphons Custodis Chimney Construction Company and is 275 ft. high and 16 ft. in diameter inside at the top. The stack is unusually high because the station is about 90 ft. below the surrounding country. Standard Custodis red brick were used in this construction, and the stack is surrounded with a cast-iron cap. There are two openings for the breeching, each 20 ft. high and 7.5 ft. wide. This breeching was manufactured by the Babcock & Wilcox Company, and the novelty in its construction was the use of ¼-in. American ingot iron plates throughout. The angle stiffeners, beam supports, etc., not being exposed to the corrosive action of the gases, are of steel.

Steam Piping

In designing the piping for this station an attempt was made to secure material of the highest possible grade, and for this reason no provision was made for a duplicate system. However, the main steam header has been so arranged that the boilers may be divided into four groups, one or more of which may be out of service at any time. This main-station header was manufactured in lengths of about 36 ft. All nozzles, including the 12-in. leads to the turbine, were welded on by an electric arc. Van Stone flanges were used throughout on all high-pressure piping 4 in. and above in diameter.

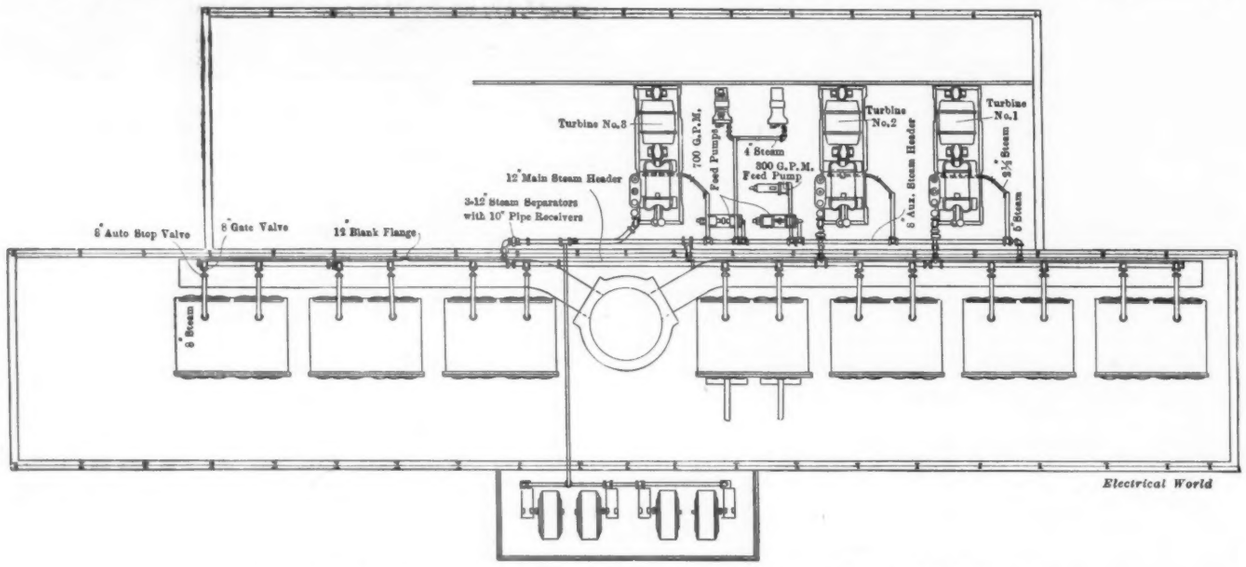


FIG. 5—PLAN OF GORGE STATION OF NORTHERN OHIO TRACTION & LIGHT COMPANY

Cast-steel fittings were used on all high-pressure superheated steam lines, and all high-pressure superheated steam valve bodies were made of cast steel, while the disks, seats and stems were of monel-metal. All high-pressure and low-pressure steam piping is covered with 85 per cent magnesia covering.

The main steam piping consists of a 12-in. header in the boiler room, connected to each boiler by 8-in. compound bends. In each of these boiler connections there is an 8-in. gate valve and an 8-in. "Foster" non-return valve. This 12-in. header is connected to the three turbines by 12-in. leads, each of which is provided with a suitable separator at the lowest point and an angle valve adjacent to the throttle valve. This arrangement allows the separator to drain the header at all times, whether the turbine is in service or not. There is an 8-in. auxiliary header in the turbine-room basement, connected to this 12-in. header at

three points, from which all connections are taken to auxiliaries, such as feed pumps, condenser pumps, blower engines, etc.

The blow-off main is taken outside the building at each end and the blow-off water conducted through a tile drain to the pond. The exhausts from the main turbines are connected to a 36-in. exhaust main which passes through the division wall and vertically alongside the stack to a point above the turbine-room roof and terminates in a standard exhaust head. The exhaust from all auxiliaries is conducted through an 18-in. main to the feed-water heaters and the heating system, as well as a vertical exhaust line extending above the roof. A relief valve is provided so that any steam not required for the heater may be wasted.

Service piping is provided throughout the building, water being obtained from a 50,000-gal. steel tank which is set on the bluff just above the station with a head of about 100 ft. This tank supplies the general service water, the cooling water for transformers, the water lines for cooling ashes and the fire lines. These fire lines are connected to the feed-water lines so that in case of fire one of the feed pumps can be used as a fire pump.

Duplicate 6-in. feed-water mains are provided, filled by the three feed-water pumps, which take water from the hot-well or discharge tunnel. Provision has also been made so that water can be taken from the cold-well or intake tunnel when necessary. In one of these 6-in. lines a 6-in. Venturi meter has been provided. The results given by this meter will be checked up by a General Electric flow meter.

A separate system of piping for condensing water is provided for each of the large turbines, and this piping is comparatively simple, consisting merely of a suction line in the wells, a discharge pipe through the condensers and the necessary connections to the booster pumps, together with the discharge. This discharge pipe is sealed in the hot-well by arranging the hot-well so that regardless of the elevation of the surface of the pond the water in the hot-well will be at least 6 ft. deep.

Air piping has been carried throughout the building, as compressed air will be used in cleaning the generators, rotaries, etc., in the turbine room, and for operating turbine-tube cleaners in the boiler room. Taps are located at convenient locations throughout this system, so that the hose connections will be comparatively short.

The oil piping for the transformers is so arranged that the oil from any transformer may be removed through this

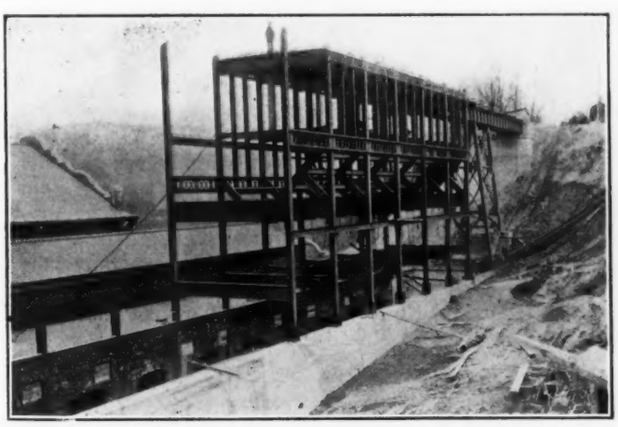


FIG. 6—COAL TRESTLE IN COURSE OF ERECTION

pipe to barrels which are set in the pit at one end of the pipe line; or, in case of fire, this oil can be run to a pit outside of the building. A complete oiling system for the main units has been installed, so arranged that the oil may be cleaned and filtered at convenient intervals. The various kinds of piping will be painted different colors so they can readily be identified.

TURBINE-ROOM EQUIPMENT

The turbine room is equipped with a 50-ton Morgan crane, fitted with one 50-ton hoist and an auxiliary 5-ton hoist, the four motors operating on a 500-volt direct-current circuit.

The present installation of generating equipment consists of three Westinghouse 6300-kw, 2300-volt, 60-cycle, three-

FIG. 7—BOILER ROOM, GORGE STATION

phase turbo-generators, 1800 r.p.m., directly connected to three Westinghouse horizontal double-flow steam turbines. The contractors have guaranteed a steam consumption not to exceed 14.8 lb. per kw-hr. at 100 per cent of rating and 15.4 lb. at 150 per cent.

The rating of approximately 6000 kw was determined on by the company, as it is not likely that the normal load during twenty-four hours will exceed that; nor is it probable that the high swings during the first year of operation will exceed 12,000 kw. Space has been provided in the open hatch previously mentioned for two additional similar or larger units in the future.

Two 150-kw steam-driven exciters have been installed and an additional motor-driven unit will soon be provided. As shown on the accompanying drawings, these exciters are placed on the turbine-room floor between main units and directly in front of the main switchboard. The exhaust steam from the turbines discharges into Westinghouse Le Blanc condensers, which are in the basement, immediately underneath the turbines. The circulating and air pumps for these condensers are on a single shaft and are driven by a 228-hp Westinghouse steam turbine. As there was a possibility that at some time the level of the pond would be drawn below the spillway of the dam, Alberger single-stage booster pumps were provided in the turbine-room basement, near the condensers, driven by 75-hp, 2300-volt, three-phase Westinghouse motors.

Three boiler-feed pumps driven by Kerr steam turbines have been provided in the basement of the turbine room. Two of these pumps are rated at 700 gal. per minute and were built by the Allis-Chalmers Company. The third pump is rated at 300 gal. per minute and was built by the Dayton Turbine Pump Company. The pipes are all interconnected and suitably valved so that any one or more may be connected to either of the boiler-feed mains. The pumps normally take their water from three Hoppes feed-water heaters which are placed on a platform midway between the turbine-room floor and the basement floor. However, the pumps have additional suction lines in both the hot-well and cold-well, so that water can be drawn from either of these

sources in case the feed-water heaters are disconnected or out of order. The feed-water heaters are filled from the hot-well or discharge tunnel by means of two 300-gal.-per-minute turbine pumps directly connected to Westinghouse motors. Two turbine service pumps directly connected to Westinghouse motors, each having a rating of 150 gal. per minute, are also located in the basement. These pumps are used filling the service tank on the bluff and also furnish the cooling water for the transformers.

Electrical Equipment

The electrical operation of the station is controlled from a gallery about 40 ft. long on the river side of the turbine room between main units No. 2 and No. 3. A benchboard on this gallery contains fourteen panels. Three of these are used for the control of the main units, two for the exciters, three for outgoing high-tension lines, three for 2300-volt lines to substation No. 3, one for 2300-volt lines to the booster pump motors, and two are blank for future connections. Indicating and recording instruments are on vertical panels above the benchboard.

The structure for the busbars and oil switches is on the main floor under the front of this gallery. The ends of

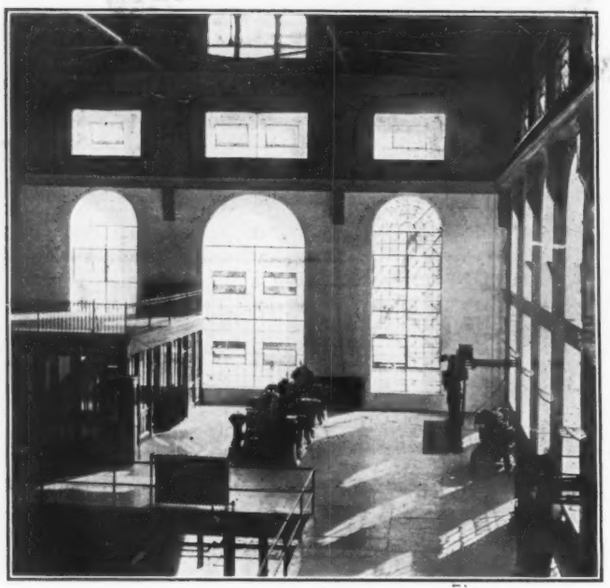


FIG. 8—ROTARY CONVERTERS AND VISITORS' GALLERY

this structure are inclosed, forming a room in which the high-tension circuit-breakers are installed. The main cables from the generators are carried under the turbine-room floor to the 2300-volt busbar. From this bus cables lead to three 3000-kw transformers. Additional transformers will be installed soon. The transformers are located in the turbine-room basement directly beneath the switchboard gallery and step up to 22,000 volts for the outgoing high-tension lines which feed the substations mentioned before. The high-tension cables pass through ducts in the turbine-room floor to the lightning-arrester room. In this room are installed three sets of electrolytic lightning arresters. Directly above this room is an initial transmission tower which is the starting point for all lines.

Substation No. 3 is located in the northwest corner of the turbine room and consists of three 500-kw Westinghouse six-phase, 60-cycle rotaries and three step-down transformers which are fed directly from the 2300-volt main busbar. The switchboard for this substation contains the necessary panels for the rotaries and outgoing feeders. Sixty-cycle rotaries were finally selected for this service to avoid frequency changes in view of the fact that remarkable progress has been made during the past few years in their design. Additional panels for switches and circuit-breakers for lighting and auxiliary motors were placed on the turbine-room floor near the substation board.

Station Operation

The station is now being operated by two shifts. The organization consists of one chief engineer and four assistant engineers. One engineer is expected to be on duty in the turbine basement and one on the main turbine-room floor at all times. In addition there is an operator on the main switchboard and one on the switchboard for Substation No. 3.

The boiler room is under one boiler-room foreman, and each shift consists of one water tender, one fireman and four coal handlers at the present time until the completion of the coal bunkers. Additional laborers are now employed removing ashes and wheeling coal into the boiler room, but when the ash-handling system is completed it will require very little attention and one or two ash handlers on each shift should be able to take care of all the ashes. When the coal bunkers are completed two men will be required to shift and unload coal and operate the coal crushers. In addition one clerk or timekeeper and one porter have been employed and from two to six boiler cleaners or laborers will be required.

The accompanying table gives the total cost of the various items entering into the structure and equipment and also their cost per boiler-horse-power.

COST DATA ON GORGE STEAM STATION

Items	Total Cost	Cost per Boiler-hp
Foundations, excavation, etc., including condensing water tunnels	$170,000	$17.60
Portion of dam, construction, tracks, etc	50,000	5.20
Superstructure	109,000	11.30
Structural steel	43,000	4.45
Coal bunkers, including structural steel, concrete, chutes, etc	112,000	11.60
Electrical equipment of station, including turbines	245,000	25.40
Crane	6,000	.62
Condensers	41,000	4.25
Pumps	10,000	1.04
Feed-water heaters	6,000	.62
Piping, heating and covering	40,000	4.15
Stack	13,000	1.35
Boilers	140,000	14.50
Breeching	11,000	1.14
Stokers	60,000	6.20
Minor instruments	10,000	1.04
Engineering and superintendence	50,000	5.20
	$1,107,000	$114.00

All foundation work and excavation for this structure was done by the company on a force-account basis. The contractor for the structural steel work was the McClintic-Marshall Construction Company, of Pittsburgh. The Carmichael Construction Company, of Akron, was the contractor for the superstructure. The M. W. Kellogg Company furnished and installed the piping, while the main units and the electrical apparatus, switchboards, etc., were furnished by the Westinghouse Electric & Manufacturing Company. Mr. J. T. Ross, of Cleveland, was consulting engineer on this work, while the writer had immediate charge of the civil and mechanical engineering features.

Electricity Derived from Refuse

As a result of development in the incinerator method of disposing of mixed refuse, the older and less sanitary method will gradually give way to this more modern method, particularly as cities increase in size. Having produced a method of destroying refuse in a sanitary and inoffensive manner, the question of how best to utilize this heat is being answered by combining a steam boiler with the furnace and producing steam at any pressure that may be desired.

Wireless and Weather

By A. H. TAYLOR

It is a well-known fact that the night range of a long-distance wireless station is often several times as long as the day range. It is also a matter of very common experience that the day range and the night range are both subject to wide variations from day to day or night to night.

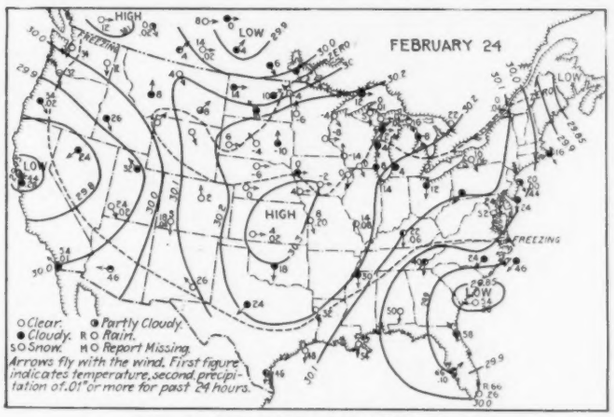

FEBRUARY 24
HIGH
LOW
FREEZING
Clear. Partly Cloudy.
Cloudy. R Rain.
S Snow. M Report Missing.
Arrows fly with the wind. First figure indicates temperature, second precipitation of .01" or more for past 24 hours.

FIG. 1—WEATHER MAP FOR FEB. 24

Reference is not here made to variations attributable to unfavorable conditions at the sender or at the receiver, such as excessive atmospheric electricity, heavy rains with consequent poor insulation, or interference with other stations, but rather to variations that may be traced to general absorption over long stretches of land or sea.

There must be a vast quantity of data on hand bearing on this problem, as every operator must have noticed some connection between transmissivity and weather conditions, but the data are scattered and not very available. The writer is not aware that any serious attempt has been made to correlate the transmissivity over long distances with the weather conditions prevailing in the region traversed by the waves. There seems to be only one tenable theory as to the source of this absorption, and that is the sunlight theory mentioned by Zenneck, Pierce and others. Ionization of upper layers of the earth's atmosphere by the ultra-violet rays of the sun is supposed to develop a slightly conducting medium which would account for the absorption.

If this be true, it might reasonably be expected that on a night following a day which has been sunny over a long stretch of country between any two stations the transmis-

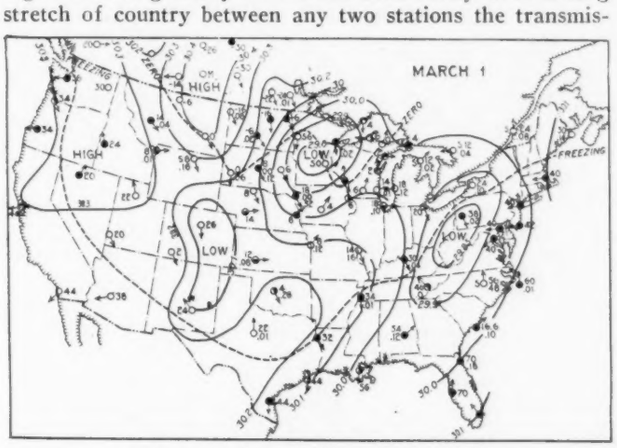


FIG. 2—WEATHER MAP FOR MARCH 1

sivity would be low, while if cloudy conditions prevail over the same area the transmissivity would be high. On the other hand, it may be argued that the ionization occurs in regions above the clouds, and that no connection between transmissivity and cloudiness should be expected.

There are few stations in this country more favorably situated for the investigation of the problem of absorption over land areas than the radio-electric station of the University of North Dakota, situated, as it is, in Grand Forks, just 1,200 miles from each coast, and within easy reach of the lake district.

The aerial is of the inverted L type, 12 ft. wide, 130 ft. long and 80 ft. above the ground. An audion receiver, used with a loose-coupler and suitable tuning condensers, has been found to be the most sensitive for long-distance work. The audions used were operated at a fixed current value somewhat less than the value necessary for maximum efficiency. This heating current was in all cases not far from 0.32 amp. The sensitiveness of an audion receiver was tested frequently by means of a standard test buzzer circuit, adjustable to any desired wave-length and damping. The applied voltage on the telephone circuit was varied so as to keep the sensitiveness at nearly the same value through a series of tests.

It was not possible to obtain United States Weather Bureau maps on the day preceding the test, but through the courtesy of Prof. Simpson, director of the University of North Dakota weather station, it was possible to get the maps on the day following the tests. This had one advantage, namely, that the observer was unprejudiced by any preconceived notions as to the bearing of the weather on results.

On Feb. 24 the author listened between 7 p. m. and 11 p. m. and heard signals from the University of Michigan, at Ann

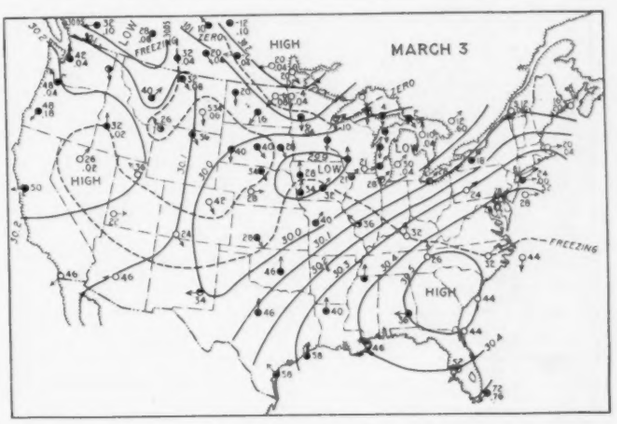


FIG. 3—WEATHER MAP FOR MARCH 3

Arbor, when 3.4 kw. was employed, as a subsequent letter from Mr. H. S. Sheppard, in charge of that station, indicated. Signals from some ten or twelve other stations along the Atlantic coast were also plainly heard.

It must be noticed that at this distance from the coast, and with a moderately high aerial (80 ft.), coastal stations and ocean vessels are heard only under rather favorable conditions for transmission.

A glance at the weather forecast for Monday morning, Feb. 24, shows two large cloudy areas moving over the northern part of the United States. This map also shows a clear area some 500 miles wide between the University of Michigan and the University of North Dakota. The test with the University of Michigan station was even more remarkable for the fact that the signals from the University of North Dakota station were heard faintly at Ann Arbor when calling with 1 kw. This test is the only one so far in which good transmission has been noticed to follow clear weather conditions, and even in this case it is seen that the whole Atlantic coast lay within a cloudy area, which extended to the westward beyond Michigan.

On Sunday, March 2, the author was not at the station, but Mr. E. C. Reinecke, an amateur at Fargo, N. D., reported a very good night. Mr. Reinecke thought he heard signals from Colon, Panama, on that evening. A map for Sunday is not sent out by the Weather Bureau, but the map for Saturday, March 1, shows a general cloudy condition all

along the Atlantic coast and from the Gulf to Winnipeg. The map for Monday shows very cloudy conditions prevailing throughout the Mississippi Valley, the lake district and the Northwest. The indications are, therefore, that Sunday was pretty generally cloudy, and both Saturday and Monday maps show general cloudiness in the area between Fargo and Key West. Whether this condition extended as far as Colon or not I am unable to say. It seems very likely.

On the evening of March 4 we were able to hear signals from the stations from both coasts, and Key West signals were received at the university and also at Fargo. The weather map for that date shows cloudiness all along the line between Grand Forks and Jacksonville, Fla., and the following day's map shows that this condition moved on down beyond Key West. The map for March 4 shows a cloudy belt to the northwest, toward Seattle and Vancouver, while the whole Atlantic coast is likewise cloudy.

The night of March 13 was one of the best as regards the number of stations from which signals were heard, but the excessive static electricity prevented any but a good operator from recognizing many calls. I have no hesitancy in saying, however, that more stations were heard from that night than on almost any other. The weather map for March 13 shows cloudiness everywhere except in the southwest.

The next test was made on March 17, and practically no signals were heard between 8 p. m. and 11 p. m. The map

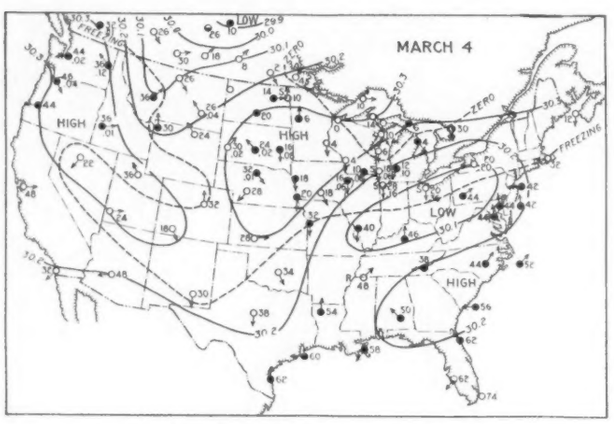


FIG. 4—WEATHER MAP FOR MARCH 4

for March 17 shows all the Eastern part of the country in a clear area. The connection seems to be obvious.

On the next evening the author thinks he identified three calls from the Pacific coast, near Vancouver and Seattle. It may have been a coincidence, but the map for the eighteenth shows a cloudy area between Grand Forks and Seattle, while the Eastern coast is clear. This seems to explain why signals from no Eastern stations were picked up that night.

The map for the eighteenth seemed to indicate that the cloudy condition would proceed eastward. Acting on this hypothesis, the author spent the evening of March 19 at the station, expecting to catch signals from many Eastern stations. Much to his surprise, not one was heard. Next morning when the map arrived it was seen that the cloudy condition had turned and swung down South through the valley of the Mississippi, and that the East had remained clear. This seems to be rather definite evidence that cloudiness and transmissivity are directly connected.

It should have been noted in connection with the test of March 17, when no signals were heard, that Michigan called us by pre-arrangement at definite intervals, using from 4 kw to 8 kw, but we were unable to hear anything.

On Monday, April 21, the University of Michigan called several times and was heard very distinctly at the University of North Dakota, although the static disturbances were very bad. No Eastern stations were heard, but signals from several in the lake district came in very strong. The weather map shows a cloudy area between Winnipeg and Chicago, but a clear region along the Eastern coast. On the following evening the author listened at the receiver between 8 and 9:30 o'clock with no result. The Michigan station did not operate for our benefit that evening, but I should have been able to hear signals from any lake stations if they had operated in that interval, if the cloudy area in that district

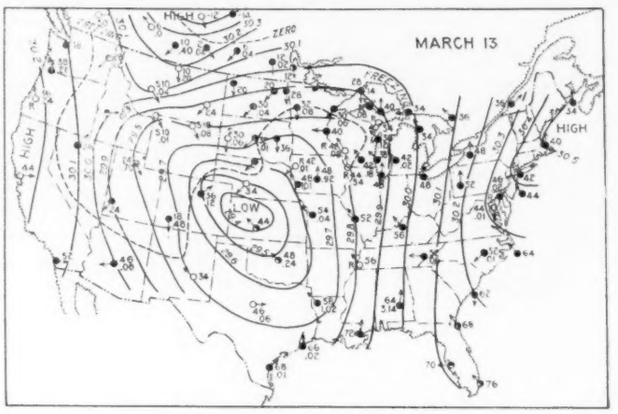


FIG. 5—WEATHER MAP FOR MARCH 13

as shown by the April 22 map has any bearing. The Eastern coast remained clear.

On Wednesday evening signals were heard from the University of Michigan station, several stations in the lake district and several on the northern Atlantic coast. The Wednesday map shows a cloudy area over all of this territory. On Thursday, April 24, Mr. Reinecke, at Fargo, reported hearing signals from a number of stations with great distinctness, an observation which was checked at the University of North Dakota station. The map for this day also shows a cloudy area in the lake region.

It would be possible to multiply greatly these instances of the connection between cloudiness and transmissivity, as I have made many random observations after sunny days of the early winter when signals from very few stations were heard, and more often none at all. So far, of some thirty observations, I have found only two which do not clearly indicate that a general daytime cloudiness over a wide area is sure to be followed by an evening of high transmissivity. It still remains to be shown whether cloudiness at transmission station or at receiving station is more fortuitous, although I am inclined to think that the transmis-

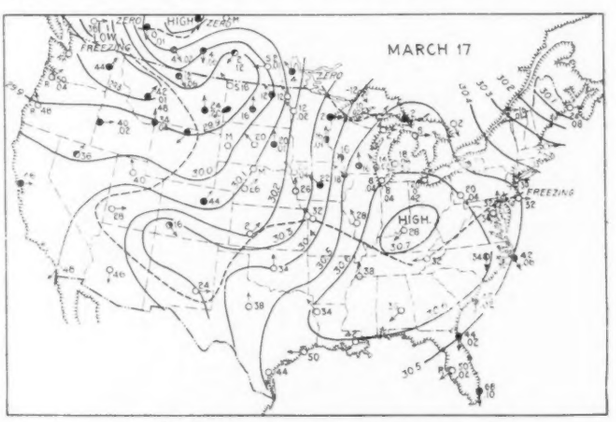


FIG. 6—WEATHER MAP FOR MARCH 17

sivity is better when the sunny area, if there is such, affects only the receiving station and its neighborhood. The transmissivity is even then not so good, of course, as it is when the cloudy area includes both the receiving and the sending stations.

If the connection between cloudiness and transmissivity be conceded, it will be apparent that the general atmos-

pheric absorption does not occur in the regions above the clouds to anything like the same extent that it does in the regions of lower level, which is contrary to previous speculations on this point.

It would also appear that far Northern stations operating in summer when the period of sunshine is of long duration should have a shorter range than in winter. It would be of interest to know if the operators of Alaskan and northern Canadian stations have any data bearing on this point. With the collection and correlation of more data on radio-transmission and meteorological conditions, doubtless some of the vagaries of wireless experimentation will be accounted for, and might even be put to practical use by weather bureaus.

Convention of Southeastern Section, N. E. L. A.

The general news features of the convention of the Southeastern Section, National Electric Light Association, held at Macon, Ga., Aug. 14 to 16, were presented in our issue of Aug. 23, together with a detailed account of the papers, addresses and discussions of the first day's sessions. Here follows a report of the technical program for the remaining days of the convention, including abstracts of the papers and the discussions they provoked.

Load Builders

"Load Builders" was the title of the paper by Mr. Milt Saul, Georgia Railway & Power Company, Atlanta, Ga., read in the author's absence by Mr. W. R. Collier, Atlanta, Ga. The author pointed out some of the opportunities open to the advertising department in building up the central-station load, a function which is of the greatest importance in successful utility operation. But no advertising campaign can ever be successful, declared Mr. Saul, without contented and satisfied customers, and a staff of employees which "makes good" in the largest sense the claims of the advertisement writer. Unless each department is performing its full duty, the advertising department's voice will soon strike falsely upon the public ear and its effectiveness will be lost. The work of the Atlanta company has included the preparation of booklets and advertisements, citing large and successful companies already central-station customers. Use is also made of direct-by-mail circular campaigns. The Atlanta company has a list of 10,000 names divided into several classes. To each of these addresses there go each month several pieces of descriptive literature. Some of the material is prepared by the advertising department itself, in order to obtain local influence and character. Some is purchased from publishers, and the manufacturers of appliances furnish another class of printed matter which is of great usefulness.

Discussion

Mr. G. K. Dustin, Columbia, S. C., recommended the use of illuminated billboards for central-station advertising. Newspaper advertising, he added, is valuable, although it should be employed on the modern principle of its commercial value rather than as a fee to the publisher.

Mr. M. H. Hendee, Augusta, Ga., testified that many purchasers of appliances had cited the moving-picture advertising shows as first awakening their interest. Mr. Hendee thought that such exhibitions are even more effective than newspaper advertising.

Mr. T. J. McGill, Atlanta, Ga., also discussed the use of advertising matter and motion-picture films furnished by the electrical manufacturers.

Mr. W. R. Collier, Atlanta, Ga., testified against the practice of sending out advertising matter with bills. Many customers in opening such envelopes conclude the inclosures to be only advertising literature and throw the whole in the waste-basket. In this way a large number of bills have been destroyed with considerable annoyance to the company and loss of the discount to the customer.

Mr. G. K. Hutchins, Columbus, Ga., said that in one instance he had received only a dozen inquiries from 100,000 pieces of advertising matter sent out. Such advertising campaigns, he concluded, are of no value unless salesmen are detailed to follow them up.

Mr. A. L. Lindsay, Durham, N. C., outlined the plans contemplated for the Society for Electrical Development.

Mr. R. L. Rand, Anniston, Ala., favored the use of newspaper and moving-picture-show advertisements. He counselled, however, against promiscuous advertising, declaring that his own card index, which lists the apparatus in use by each customer, has been found most valuable at Anniston.

Mr. T. W. Peters, Columbus, Ga., suggested that the manufacturers might well do less advertising in the popular magazines and devote more to local campaigns. Direct solicitation from salesmen, he concluded, is of the greatest importance.

Mr. W. A. Belcher, Cordele, Ga., declared that newspaper advertising gets down to "the human touch." In one case which he cited the local central station was confronted with prospective customers using twenty-two languages. Salesmen, however, were hired who could speak various tongues, and with the aid of a card index much desirable business was obtained.

Industrial Motor Service

"What Is a Horse-power?" was the title of a paper by Mr. Albert Milmow, Alabama Power Company, Birmingham, Ala., in which the author recommended departing from strictly technical terms in closing commercial motor-service contracts. Since the characteristics of electric drive are so different from those of the older forms of motive power, attempts to compare the two with the common unit are likely to lead to misapprehension and prejudice. For this reason, the definition suggested by the author is "a unit for the measurement of manufactured articles produced."

In comparing the cost of steam plants and motors all items must be included. Certain cotton mill engineers have cited $30 to $40 as the cost per hp of steam-engine capacity, compared with $18 to $30 per hp for equivalent motor installations. Another eminent designer placed the same figures at $33.90 for electric drive, against $79.04 for steam drive. In approaching the customer when a contract is to be closed care must be taken to present the proposition to him in its simplest possible terms. In the meantime, if it is necessary to use maximum demands, load-factors, etc., for equitable rate determinations, such terms should be made plain to the central-station's clients. It is the salesman's duty to see that the customer is contented, that he understands his rates knows he is getting a square deal and can read his kilowatt-hour consumption and use it as an index to his operating conditions.

The paper was discussed briefly by Messrs. J. S. Bleecker, Columbus, Ga.; W. R. Collier, Atlanta, Ga.; G. K. Hutchins, Columbus, Ga., and A. H. Sikes, Macon, Ga.

The Hotel Load

Mr. C. A. Collier, Georgia Railway & Power Company, Atlanta, Ga., followed with his paper on "The Hotel Load." After pointing out the desirability of this class of business as a consumer of both electrical energy and steam heat, the author presented tabulations of data showing the installations in certain Atlanta hotels, together with curve sheets revealing the load characteristics of their lighting and motor service. One of the great talking points for the isolated plant is the claim that if engines are installed steam heating will cost nothing. As a matter of fact in the Atlanta district not more than 30 per cent of the steam needed for heating is available as exhaust, and of the total quantity of exhaust steam not over 30 per cent can be used for heating during the heating season.

Compared with exhaust-steam heating, the use of low-pressure boilers in one case was found to effect an addi-

tional outlay of only $750 per year, an amount offset several times by the saving through the purchase of energy from the central station. In conclusion, said the author, the more carefully the hotel load is analyzed the more attractive it will appear as central-station business. The commercial department of the central station can therefore use its efforts to no better advantage than in securing hotels as customers, to which end the many small reasons which recommend this class of service are of no less importance than the larger ones.

Discussion

Mr. W. L. Southwell, Macon, Ga., described the electrical equipment of the Hotel Dempsey, Macon, Ga., where the convention was being held. The Dempsey's connected load in motors aggregates 185 hp, two motor-generator sets supplying the elevator direct-current service. The building is lighted by 25-watt lamps and the consumption averages 25,000 kw-hr. per month.

Mr. E. S. Roberts, Savannah, Ga., reminded his audience that they must not overlook the cosmopolitan and resort character of the hotel load in certain Southern cities. In many towns, however, the hotels are largely closed during the summer, while their large winter load makes undesirable seasonable business.

Mr. M. Webb Offutt, Birmingham, Ala., cited the government report on a 150-kw-hr. isolated plant at Fortress Monroe, where it was shown that the cost of developing energy was 4.32 cents per kw-hr.

Mr. H. C. Adams, Jacksonville, Fla., told of the conditions met by his company, which operates sixty small plants whose principal business is ice-making. The Florida hotel season is short, lasting only three months during the winter, but the hotel managers and proprietors can be convinced only with difficulty that a comparatively high rate is just for such short-season service.

Alternating-current elevator electric motors are now being used with success, declared Mr. W. R. Collier, Atlanta, Ga. One has operated in Atlanta during the past four years and makes no trouble or noise.

Mr. M. H. Hendee, Augusta, Ga., questioned whether the rates under which the two large tourists' hotels in his city are supplied can return much profit to the company.

Mr. E. C. Deal, Augusta, Ga., added that he would also much prefer furnishing service to year-round hotels at even a lower rate per kilowatt-hour than short-season service at a high rate.

Mr. M. H. Rourk, Macon, Ga., manager of the Hotel Dempsey, discussed central-station service from the hotelman's viewpoint, recounting his experience with a $50,000 isolated plant in the Hotel De Soto, New Orleans. When a strike occurred there the central-station throw-over service proved of the greatest value to this plant. But hotel men everywhere, explained Mr. Rourk, want a flat monthly rate for central-station service, and he declared that a large amount of hotel business could be closed if the central-stations were willing to meet these conditions.

In commenting on Mr. Rourk's remarks, Mr. E. H. Ginn, Atlanta, Ga., inquired whether hotels would in turn be willing to sell their service to guests at a flat rate. Others who took part in the discussion were Messrs. C. D. Flanigan, Athens, Ga.; H. L. Wills, Atlanta, Ga., and T. J. McGill, Atlanta, Ga.

Controlled Flat-Rate Systems

Mr. A. T. Holbrook, Excess Indicator Company, Pittsburgh, Pa., closed Friday morning's program with a paper on "The Sale of Energy on a Flat Rate by Means of a Current-Limiting Device." Among the arguments cited by the author to meet objections brought up, were: (1) The existence of thousands of small customers now using oil or gas for lighting, but who cannot be obtained as central-station customers by any other than the flat-rate method. (2) Present residence customers who have electric irons or other appliances find difficulty in changing over from a meter to a flat rate, so that the effect on present meter customers need not be considered. (3) The inherent tendency of the public to buy service on the American plan causes many people to pay 25 to 50 per cent more for a flat-rate commodity than for the same commodity on a measured service. In other words, "knowing exactly the cost," is an even larger factor than the economy involved. (4) Records obtained with check meters show that the rate per kilowatt-hour secured under flat-rate systems, at 1 cent per month per watt connected, compares favorably with existing meter rates.

The recent campaign in Atlanta, Ga., resulted in 1200 contracts, of which 728 were houses actually signed up for wiring. Gas arcs to the number of 332 were also replaced. Other campaigns have been in progress in the towns of the Carolina Power & Light Company, where 930 new customers were obtained with an increased income of $14,784.

Discussion

Mr. J. E. Bingham, Tampa, Fla., declared that flat-rate campaigns open virgin fields for the solicitor, enabling classes of business to be taken on which were hitherto considered unprofitable. He questioned, however, the use of a force of outside solicitors and suggested that the various items of cost, including disconnections, customers' moving, etc., be included.

Mr. T. W. Peters, Columbus, Ga., described the large use of prepayment meters in his own city, where they are designed to secure the same class of business as is reached with the flat-rate controller. His 325 prepayment meters average 9.5 cents per kw-hr., with an approximate demand of 180 watts. The average use is 3.4 hours per day, and the meters return an average income of $21 per year. Loss of collection, he declared, is also smaller than that with the flat-rate system. The cost of obtaining a prepayment customer has averaged only 20 per cent of the yearly revenue.

Mr. M. Webb Offutt recounted the experience of the Hartford (Conn.) company in adding to its lines flat-rate customers who hitherto could not afford metered electric service. Mr. Offutt also brought up the question of the attitude of public-service commissions toward flat-rate propositions as constituting special rates favoring certain classes of customers. He referred to the use of "blue meters" in crediting delinquent customers for past debts, and for certain classes of business he further suggested the use of the prepayment meter set at a higher rate, but without the minimum charge.

Mr. W. A. Belcher, Cordele, Ga., told of securing 201 contracts totaling 24.5 kw with a revenue of $3,215. The average income per customer was $16 per year at a maximum demand of 131 watts.

Mr. H. C. Adams, Jacksonville, Fla., pointed out that unless the flat-rate customer "sticks" his contract may have been secured at a loss to the company.

Mr. M. H. Hendee, Augusta, Ga., recounted a campaign in which three solicitors secured 1357 flat-rate customers, netting 945 permanent flat-rate users after 145 had quit the service and 135 others had changed to metered service. The monthly revenue obtained was $2,227, and incidentally 801 house-wiring contracts were closed. Check meters installed showed an average earning of 9 cents per kw-hr. (without lamp renewals), compared with 10.7 cents per kw-hr. under the regular meter rate (with lamp replacements).

Mr. J. S. Bleecker, Columbus, Ga., suggested the use of an inspection service to take the place of controlled circuits.

Mr. J. H. Robertson, Greensboro, N. C., reported earnings of 8.5 cents per kw-hr. as shown by check meters installed in connection with a flat-rate system whose charges ranged from 1 cent to 3 cents per connected watt per month. The equivalent meter rate was 12½ cents per kw-hr.

Mr. T. B. Culley, Augusta, Ga., reported that flat-rate

collections there have been good and that the flat-rate business obtained has been very desirable. Incidentally, bookkeeping is reduced to the minimum.

Mr. G. K. Dustin, Columbia, S. C., urged that central-station men do away with the usual uncertainty of customers' electric-light outlays by advising their customers to read their own meters and to control their consumption to fit their pocketbooks.

In conclusion, Mr. Holbrook, the author of the paper, declared that no objection has ever been raised by any commission to controlled flat-rate systems when offered as an optional rate. If, of course, a local ordinance specifies the rate, it is necessary to have a new ordinance drawn up. Hartford, Conn., has 4000 controlled flat-rate customers and 5000 metered customers, the income per kilowatt-hour being practically identical, averaging 6 to 4 cents. The income per capita at Hartford, said Mr. Holbrook, is $11 per year.

PUBLIC POLICY SESSION

At the public-policy session of Friday evening Mr. John S. Bleecker, Columbus Power Company, Columbus, Ga., presented a paper on some of the broader aspects of public relations, pointing the way to an attitude of better understanding on the part of both public-service corporations and public.

Public-utility monopolies, he said, must recognize that they are public utilities, the servants not the masters; they must remember that they are monopolies and not discriminate; they must give good service; they must not expect unreasonably high returns; they must encourage and assist the properly selected bodies which represent that average individual they wish to reach; they must not be over-sensitive nor overbearing; they must be frank, fair and efficient, and they must look for the bright side of that dark cloud. It is beginning to show. They can help turn its smiling countenance to the light by telling the public who they are, and what they are and why.

Following Mr. Bleecker, Mr. M. Webb Offutt gave a short address, taking as his text co-operation between central station, manufacturer, contractor and engineer. He also urged getting the support of the architect in the wiring of buildings and the arrangement of illumination. Central-station companies, he declared, should be close together in the discussion of vital questions and the interchange of policies. One great value of the State association has been in its attention to matters of State legislation, matters which demand most serious consideration. Not only is the customer entitled to a reasonable rate for his service, but the company as well should be allowed a reasonable return on its investment.

The treatment of labor, added Mr. Offutt, is one of the problems before the central station. It is important that the central-station manager gain the co-operation and interest of his employees. Profit-sharing and old-age pensions are two steps in the right directon.

Mr. T. H. Burch, Griscom-Russell Company, New York, followed with a brief discussion of the advantages secured by the use of evaporators in connection with electrified ice plants.

ELECTRIC TRUCK SALES TO MERCHANTS

"The Sale of Electric Trucks to Merchants by Central-Stations" was discussed by Mr. H. W. Hillman, Electric Vehicle Company, Long Island City, N. Y., in a paper read in his absence by Mr. G. K. Dustin, Columbia, S. C. The author cited the experience of Hartford, Conn., Baltimore, Md., Vancouver, B. C. and other cities in the sale and promotion of electric trucks. He insisted that any community should support one electric truck for each 1000 of its population. Mr. Hillman urged that central stations extend to the local merchants the necessary leadership to promote electric truck sales, overlooking no opportunity to install battery-propelled vehicles for hotel-bus, commercial-truck and other purposes. He made a special point of the reliability and prestige added to the sale of electric trucks if handled by the local electric-lighting corporation, whose reputation is already well established in the community. In conclusion, the author presented comparative data on the cost of electric, gasoline and animal-drawn conveyances.

Discussion

Mr. E. D. Craig, Savannah, Ga., opened the discussion by pointing out that manufacturers of electric vehicles limit their agents to only one brand of car, although gasoline-car agents usually handle several cars. Until the time comes when one line will keep the agent busy, Mr. Craig recommended that the manufacturers remove their restrictions and allow agents to handle other cars.

Mr. J. S. Bleecker, Columbus, Ga., reported his own experience with an electric vehicle on consignment and criticized the attitude of the vehicle manufacturers as being narrow.

Mr. M. Webb Offutt, Birmingham, Ala., testified to the thoroughly satisfactory experience of his company with a 2-ton truck in operation four years and followed by the addition of other cars. He pointed out the advantages of sales offered by the central station, but also called attention to the lack of faith in the electric vehicle often seen on the central station's part. A feature of the electric-vehicle load is the aspect of controlling its off-peak characteristics. If the company will establish a storage service it can hold machines until after 10 p. m., then plunging in the cars for charging during the off-peak hours.

Mr. W. R. Collier, Atlanta, Ga., declared that the central station should go no further than to work up interest in electric vehicles and to pave the way for the manufacturer's salesman.

Mr. J. T. Hart, Cleveland, Ohio, said that central stations lack information concerning electric trucks. These cars can climb hills easily and have ample mileage for city haulage. He urged that the central station itself lead off in the use of electric trucks.

DAILY METER READING

The advantages of reading meters and billing continuously during the month were pointed out in a paper by Mr. F. B. Culley, Augusta, Ga., presented at the Saturday morning session. Under the older once-a-month plant the metermen were employed at other mechanical work during fully two-thirds of their time, while during the reading periods their number had to be swelled by recruits from other departments. With the daily-reading schedule, however, the readers are employed continuously and regularly, and readers and meter-repair men each have their definite functions in which they become very proficient and of great value to the company. One central station having 3043 meters scattered over 12 square miles of area accomplishes the full reading in twenty working days with only one meter reader. This reader is not at all rushed and has opportunity to make various investigations when necessary. He is required to make subtractions before leaving each meter and is thus assured that his work is correct. If there is a discrepancy, the reason is sought at once while still on the ground, and the fullest obtainable data are handed in to the accounting department at the beginning, thus avoiding delays. The effect of daily readings is also reflected in the even loading on the treasurer's office and cashier's window.

Among those taking part in the discussion were Messrs. A. A. Wilbur, Columbus, Ga.; W. L. Southwell, Macon, Ga.; J. E. Bingham, Tampa, Fla.; E. S. Roberts, Savannah, Ga.; J. H. Robertson, Greensboro, N. C.; R. L. Lindsay, Durham, N. C.; W. R. Collier, Atlanta, Ga.; E. C. Deal, Augusta, Ga; J. S. Gleecker, Columbus, Ga., and M. H. Hendee, Augusta, Ga. Of this number five reported that they are already using the daily-reading scheme, and three of the others are considering adopting it.

Municipal Ice-Electric Plant in Oklahoma

Although certain large cities have agitated the question of municipally controlled ice factories, the little town of Weatherford, Okla., with a population of 2116, has installed what is said to be the first plant of the kind in the country. This installation is interesting not only because Weatherford was foremost in trying out the economies of

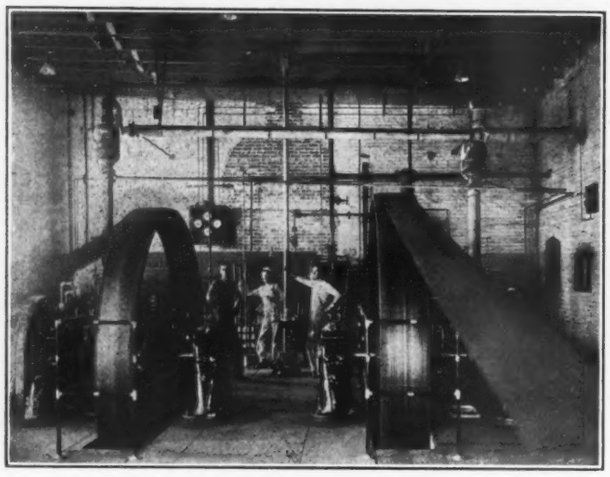


FIG. 1—ENGINE ROOM, WITH ABSORPTION-TYPE ICE-MAKING EQUIPMENT IN REAR

a small plant but because of the possibilities shown here, as elsewhere, for utilizing the exhaust steam from the generating station.

In response to questions contained in a letter received from the president of the borough of Manhattan, New York City, the commissioner of public utilities at Weatherford, Mr. Hugh J. Cooper, made the following statement: "The practical operation of our plant has proved that the theory of connecting an ice plant with a power plant is a correct one."

The strongest opposition which was maintained against the municipally operated ice plant was that the city would be unable to obtain economical results with such a small equipment. The point made in this opposition, said Mr.

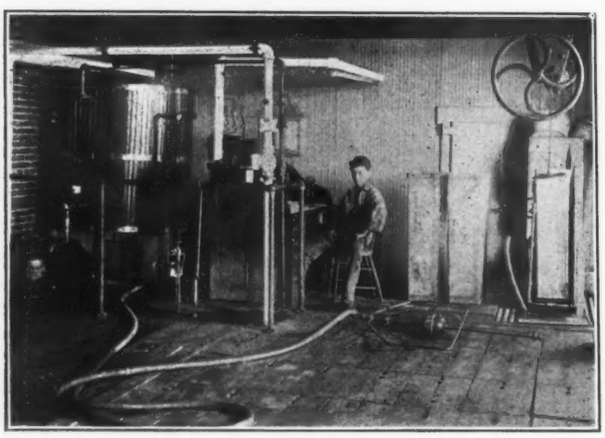


FIG. 2—INTERIOR OF TANK ROOM

Cooper, has been answered by trial, and the economy which characterizes the operation of this municipal plant now attracts the loudest part of the praise accorded to it.

The plant has already been in operation three months and has a normal output of 10 tons of ice a day, but can produce 15 tons by crowding. The cost of manufacturing is 50 cents a ton, and consists of 40 cents for labor and 10 cents for fuel. The price delivered to the consumers for amounts less than 1000 lb. is 40 cents per 100 lb.; 1000 lb. or more, in full blocks in one delivery, 30 cents. Prices on the platform for 300 lb. or less are 40 cents per 100 lb.; for 300 lb. to 1000 lb. in full blocks, 25 cents, and for 1000 lb. or more, 20 cents. In car-load lots the price per hundred is 15 cents or $3 per ton f. o. b. from the plant's railroad siding. According to the data obtained, the cost of delivery is $2 per ton.

The installation cost the city $11,000, appropriation for which was obtained by utilizing a fund which was originally raised by the city for the erection of a city hall. Mr. Cooper decided, however, that an ice plant in connection with the generating station and water-works was more badly needed than a city hall, which would probably entail additional help and equal expenses. He convinced the city of its need and the ice plant was erected.

Figures quoted in the preceding paragraphs are quite comparable with the rates given by larger plants. The equipment used in manufacturing the ice is the absorption type, and was furnished and installed by the Carbondale Machine Company, Carbondale, Pa. Exhaust steam from the generating units is employed to evaporate the ammonia solution and compress the resulting ammonia gas. Water for cooling

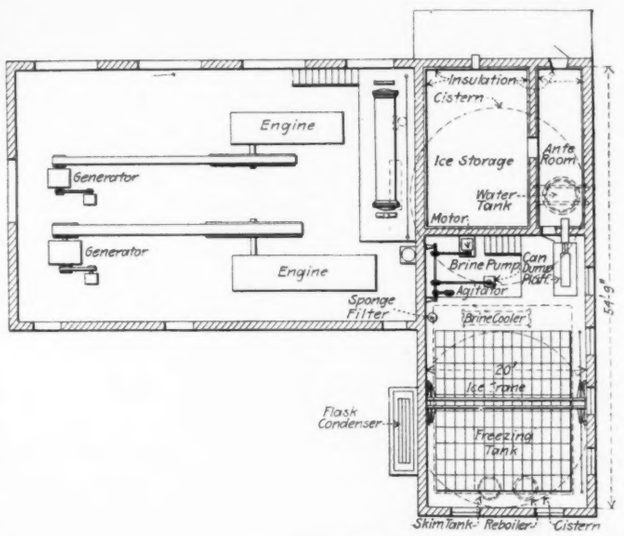


FIG. 3—PLAN OF STATION, SHOWING ICE-MAKING EQUIPMENT

the ammonia condensing coils is obtained from the city's pumping station, which is run in conjunction with the generating station and ice plant. As this water is not contaminated by the operation of cooling, it can be drained back into the storage reservoirs which contain the city's water supply, so that there is practically no expense connected with use of cooling water. The temperature of the condensing water is 65 deg. Fahr., and the exhaust steam pressure is 3 lb. per sq. in. Pressure is maintained by a reducing valve placed between the exhaust main and the ice equipment.

To accommodate the additional ice-making apparatus, including the freezing tanks and cold-storage rooms, it was necessary to build an extension on the existing generating station about 27 ft. wide and 57 ft. long. The storage room is designed to hold about two days' supply of ice. The tank room contains 140 300-lb. freezing cans, which are cooled by brine circulation, maintained by motor-driven agitators. The same 5-hp Wagner motor also drives a centrifugal brine-circulating pump. The ammonia absorbers, condensers, weak liquor coolers and rectifiers are installed on the roof over the new tank house. The ammonia generator and pump are located in the engine room, and in this way take up very little space.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Reduced Monthly Minimum in St. Louis

Beginning Aug. 1, the Union Electric Light & Power Company reduced the monthly minimum bill for residence lighting from $1 to 50 cents. Prior to the establishment of the present residence schedule, the monthly minimum was charged at the rate of 3 cents per month per lamp connected, the charge in no case being less than $1. When the reduced residence schedule went into effect this monthly minimum was reduced to $1 flat for all residences. The present reduction brings the monthly minimum to 50 cents.

Prizes for Students' Central-Station Essays

Early in the school year the Union Light & Power Company, of Franklin, Mass., offered to the graduating class of the local high school a cash prize for the best paper on the subject, "The Value of Electricity for Light and Motor Service, and the Part an Electric-Light Company Should Play in the Life of a Thriving, Progressive Community." Many interesting, well-written and logically thought-out papers, reviewing the principal central-station arguments, were received, two of which were considered worthy of prizes. The company was well pleased with the result and next spring will repeat the offer to the graduating closs of 1914.

Selling Appliances in Combination

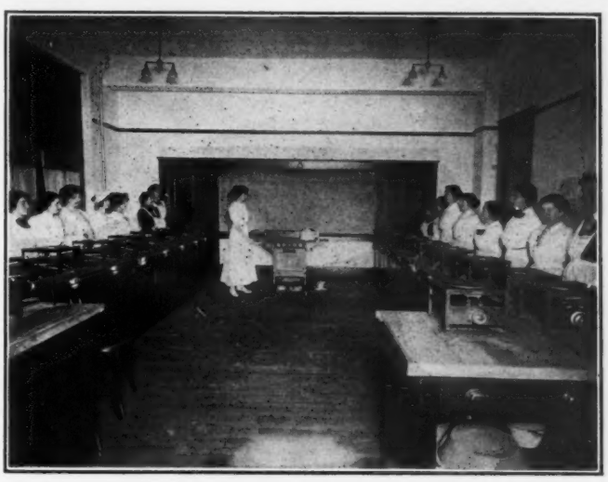
By selling electrical household appliances in groups combined at the choice of the purchaser, the Narragansett Electric Lighting Company, of Providence, R. I., has done much to stimulate popular interest in its service. The following energy-consuming devices are sold in sets of three each at a discount of 33⅓ per cent from the sum of the listed prices in each case: Percolator, $6.08; teapot, $6.48; toaster, $3.23; 6-in. stove, $4.05; egg boiler, $6.75; chafing dish, three sizes, $4.05 to $10.98; flatiron, $3.50. By this scheme a visitor to the company's showroom can secure, for example, a flatiron, a percolator and an electric toaster at a net cost of $8.54, compared with an individual total of $12.81. The plan of offering prospective users of heating devices a choice of such wide range has been particularly successful in comparison with that of offering low prices temporarily on a single piece of apparatus.

Contractors Co-operate in Electrical "Movie" Matinee

With the co-operation of local electrical contractors, an electrical moving-picture matinee was recently given by the United Electric Light & Water Company, of Greenwich, Conn. The local theater was leased for the afternoon and the affair advertised in the newspapers and by the distribution of complimentary tickets. To add interest to the occasion it was announced that an electric toaster would be given to the lady holding the ticket bearing the lucky number. A number of excellent motion-picture reels and lantern slides were loaned by the manufacturing companies. As the performance was run with the aid of the local electrical contractors the expense was comparatively small. It stimulated, however, a great deal of interest in electrical devices, besides creating much favorable comment from both the public and the press. The performance was held under the direction of Mr. G. F. Atwater, superintendent, and Mr. E. F. Putnam, commercial manager of the Greenwich company.

Electric Cooking at Hattiesburg (Miss.) Normal School

The Mississippi State Normal School at Hattiesburg, Miss., is now equipped with complete electric cooking apparatus for instruction in domestic science, the courses in which are in charge of Miss D. Campbell. As shown in the accompanying illustration, one of the schoolrooms is provided with twenty General Electric 1500-watt, three-circuit, 8-in. disk stoves installed on benches ranged along the two sides of the room. In the center there is also a full-sized electric range with a total connected load of 6.3 kw, which is used by the instructor in demonstrating culinary operations to the class. This electric-cooking equipment has proved such a success at the Hattiesburg school that it is now planned to double the installation, adding also a modern electric range of the latest type. Energy for the operation of these electric-cooking devices is furnished by the Hattiesburg Traction Company.



CLASS IN ELECTRIC COOKING, HATTIESBURG, MISS.

Electric Truck for Long Ice Hauls

In a Southern city of 20,000 inhabitants the local combination ice-electric company has made successful use of a 3-ton battery-driven electric truck for hauling ice to outlying distribution points, from which the horse-drawn wagons deliver it to customers. In this way the one electric truck has replaced four single-horse wagons, with a great saving to the company. The truck loaded with ice is sent around fixed circuits, meeting the returning delivery wagons and

replenishing their exhausted stocks. Trips are made daily to both the east and west sides of the city. At a load the truck can carry fifteen 300-lb. cakes of ice. By motor delivery of the ice to the wagons the latter are saved the time and labor of the long haul back to the plant and return. A smaller number of wagons are thus enabled to get through with the delivery in much shorter time, while the working conditions of both animals and deliverymen are improved.

Roller Skates for Storeroom Employees

Employees in the storerooms of central stations where the distances traversed are relatively large might find their work facilitated by the aid of roller skates, a novel departure which is actually in use with considerable success by the Union Street Railway Company, of New Bedford, Mass. This company's storeroom attendants are fitted with skates to accelerate their movements, and they thus save

USE OF ROLLER SKATES BY ATTENDANTS IN STOREROOM

considerable time in getting at stock. When one of the men receives a request for material at the delivery window he skates back to the section of the storeroom containing the required article and promptly returns with it to the delivery window. The use of the skates does not hamper the storeroom employees in mounting ladders for the purpose of reaching elevated bins in which material may be stored, as experience has shown that they are able to mount ladders to reach such places without removing their skates.

Overtime Electric Drive for the Laggard Department

Motor-service salesmen often enlarge on the well-known point in favor of central-station drive to the effect that when power is not needed a switch can be thrown and all expense stops. While this is good argument, commented Mr. Albert Milmow, of the Alabama Power Company, Birmingham, Ala., in a paper before the convention of the Southeastern Section, N. E. L. A., at Macon, Ga., Aug. 15, he insisted that it is really of much greater importance to emphasize the fact that electric power is not intended to stop with but to run with, and if some department runs ahead it clearly is much more desirable that the others which are lagging should be operated overtime than that the advanced department should be curtailed. This view, he has found, always carries weight with a business man. The latter will probably say, "Oh, well, I run my engine overtime," and so he probably does, but if he does, it is not until the discrepancies between his departments are so great that loss has resulted. In a long experience with a large number of electrically driven cotton mills, the writer said he did not recall a single case where power is not run for extra time, although only a very small fraction of the total rating may be required, an amount usually altogether too small to warrant the running of a large steam plant.

The Hotel as a Central-Station Customer

Probably no other type of customer offers the central station so large a revenue from the sale of energy or affords so advantageous a subject for advertising central-station service as the hotel, declared Mr. C. A. Collier, of the Georgia Railway & Power Company, Atlanta, Ga., in a paper presented before the recent Southeastern convention at Macon, Ga. To other prospective customers the fact

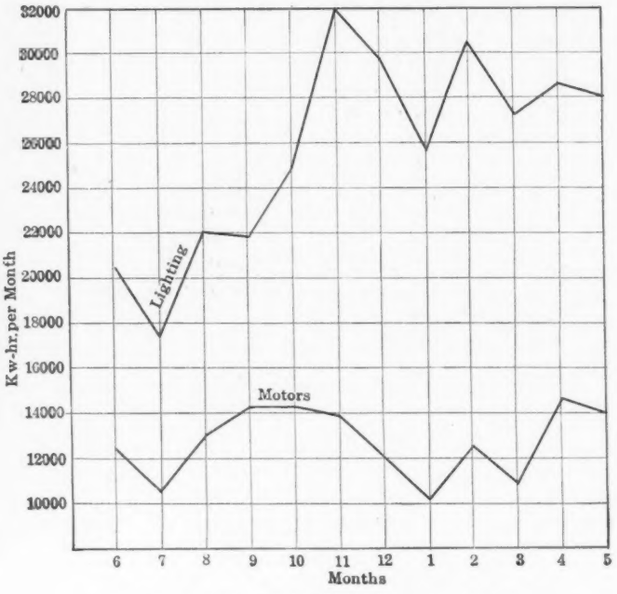


FIG. I—YEARLY ELECTRICAL CONSUMPTION

that the hotel—usually the newest and largest building in the community, requiring the most reliable service at an economical figure—has decided upon the purchase of electric service, instead of manufacturing it, carries more weight than an all-day selling talk.

Again, looking at the hotel only as a consumer of energy, it is found that very few types of commercial business (some industrial plants excepted) consume as much energy per kilowatt connected as does the modern hotel. For instance, the combined average load-factor of two of the hotels mentioned herein is approximately 20 per cent, whereas the load-factors of other types of business are only as follows: Office buildings, 7 to 15 per cent; department stores, 8 to 10 per cent; newspaper publishers, 8 to 14 per cent. In other words, the ability of a hotel to use energy is almost double that of any other large commercial consumer.

Another factor certainly to be considered in connection with this comparison is the relatively small peak of the hotel load, and the absence, in comparison with other types of business, of the large "valleys," representing the hours of the day when little or no energy is used. In fact, the hotel, during every hour of the day, is a considerable user

of electricity, as shown by the accompanying curve. Especially is this true if the hostelry operates a machine for refrigeration and ice making, as the ice making is largely done during the night hours. The fluctuation due to the change in seasons is also less than for almost any other type of business.

There is nothing more important than reliable service

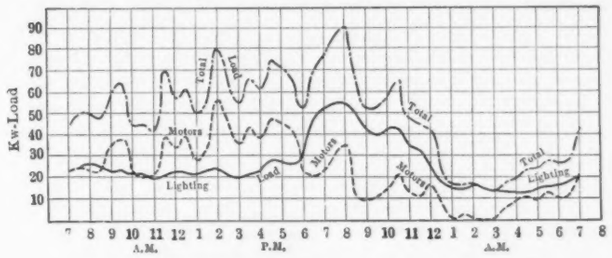


FIG. 2—HOURLY ELECTRICAL LOAD FOR JULY

in order to obtain and hold the hotel as a customer. To supply such service from an isolated plant means the installation of at least duplicate, and quite often triplicate, generating units at a very high initial cost. Such a plant must be kept in prime condition and guarded from shut-downs due to labor troubles and non-delivery of coal.

In Table I there are given detailed data for four typical hostelries, representing as many characteristic types of hotel service. Hotel "A" is a modern large building, thor-

TABLE I—ELECTRICAL AND STEAM-HEATING DATA FOR FOUR HOTELS

	A	B	C	D
Lighting load in 50-watt equivalents	3,200	2,600	454	1,250
Connected motor load in hp	150	128	70	160
Heating load, sq. ft. of radiation	16,000	1,200	3,963	12,000
Annual lighting consumption, kw-hr	307,000	334,000	19,288	118,500
Annual motor consumption, kw-hr	153,000	177,000	3,056	183,000
Building heating, lb. steam annually	6,400,000	4,800,000	1,565,000	4,880,000
Kw-hr. per 50-watt lighting equivalent per year	96	128	43	95
Kw-hr. per hp per year	1,020	1,383	152	1,045
Lb. condensation per sq. ft. radiation per season	400	.....	398	400
Load-factor of lighting, per cent	22	29	9	21
Load-factor of motors, per cent	16	21	2.5	17

oughly equipped with motors throughout, but having no ice machine. Hotel "B" has the same general characteristics as "A," with the addition of a 10-ton ice machine. Hotel "C" is a small hostelry, with no motors other than one elevator. Hotel "D" is equipped with individual-motor drive and is the most modern of the group.

TABLE II—ENERGY CONSUMPTION FOR FOUR HOTELS

	Maximum, Kw-hr.	Minimum, Kw-hr.	Ratio of Maximum to Minimum, per Cent
Hotel "A"	45,000	27,700	60.5
Hotel "B"	51,300	36,200	71.0
Hotel "C"	2,840	1,240	43

For the sake of comparison, the minimum and maximum monthly consumptions for Hotels "A," "B" and "C" are also tabulated, in Table II.

Here is shown conclusively the advantage to the central station of the ice machine in increasing the commercial load.

THE EXHAUST STEAM-HEATING FALLACY

The greatest talking point of the advocate of the isolated plant is the claim that if engines are installed, the steam heating will cost nothing. There is probably no greater error generally made, or one which, for the lack of specific information, goes so often unquestioned.

As a matter of fact, not over 30 per cent of the steam necessary for building heating in the vicinity of Atlanta is available as exhaust steam, and of the available 100 per cent of exhaust steam not over 30 per cent can actually be used for heating during the heating season.

As an illustration, Hotel "A" has installed 16,000 sq. ft. of radiation. This radiation condenses during the heating season approximately 5,600,000 lb. of steam, of which over 60 per cent is condensed during the months of January and February, leaving only 2,240,000 lb. of steam to be condensed in November, December, March and April.

The kilowatt-hour consumption during the four months November, December, March and April was 169,000. Taking the N. E. L. A. figure, 60 lb. of steam per kw-hr., the exhaust steam available during the above-mentioned four months is 10,140,000 lb., or practically five times the steam-heating demand. Despite even this large excess, actual running tests show that the steam-heating demand in the early morning hours is so great that it exceeds the output of exhaust steam available, resulting in live steam having to be supplied to the heating system.

In connection with the using of exhaust steam for heating, it must be remembered that there are few systems indeed that show no back pressure. This back pressure directly affects the operation and economy of the engine, owing to the fact that not only is the horse-power of the engine reduced but the steam consumption per kilowatt-hour output due to cylinder condensation is greatly increased. Therefore, the net results shows very little gain in the direction of economy. In fact, Hotel "A" can be heated from low-pressure boilers at a total over-all cost of $2,500 per annum. This $2,500 per annum would be reduced to a maximum of only 30 per cent of $2,500, or $750, by the use of exhaust steam from the engines. This $750 is offset several times by the saving in the purchase of energy from the central station.

The question also arises as to the supply of steam for hot water, cooking, etc. In Hotels "A," "B" and "D" this is handled by boilers of approximately 50 hp, two in each hotel, the only labor required being negro firemen at wages somewhat lower than if an isolated plant were operated. Except in the morning and at mealtimes there is no heavy demand for heating and cooking, so the necessity of close attention or heavy firing is avoided.

Assuming that individual plants of the proper size, type, etc., were installed to supply these hotel buildings, and crediting each plant with one engineer and two firemen, and the additional coal, etc., directly chargeable to steam heating, the

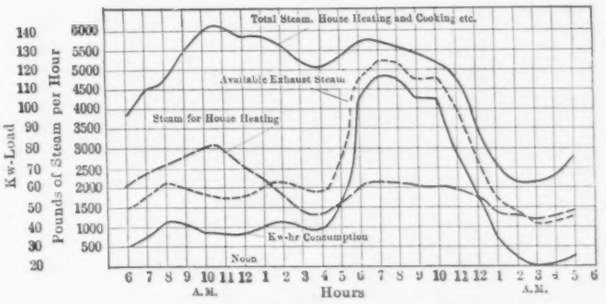


FIG. 3—DAILY LOAD CURVE FOR JANUARY

cost of manufacture per unit of energy will be very close to 4 cents per kw-hr., including all charges. The remaining credit for exhaust steam for heating being very small, it will hardly affect the cost per kilowatt-hour at all. The above figure will, of course, vary somewhat with the cost of fuel, labor, etc., but, generally speaking, it is about correct.

Appealing to the Customer Through the Monthly Bill

The Greenfield (Mass.) Electric Light & Power Company makes effective use of the back of each customer's monthly bill in the line of publicity regarding rates and service matters, the management holding that as the bill is always scrutinized with much more interest than loose publicity matter and is in many cases retained for long periods as a receipt, it offers one of the most direct channels of appeal to the user of electric service. The monthly bills are rendered on forms 4¾ in. by 10½ in. in dimensions, and on the reverse side of each lighting bill are printed the rates for incandescent service, an explanation of the footing of the consumption charge and the service charge, the advantages of electric signs and a list of "Facts and Suggestions" outlining the company's policy regarding the loan of electric irons on fifteen days' free trial, interest on the consumer's deposit, free renewals, where to obtain instruction in meter reading and the benefits of reading lamps and other domestic appliances. The company points out that its service charge is very low, being 41 cents per month to all customers whose bills are less than $1.50 per month, and states that its purpose is to pay the interest, depreciation and maintenance charges on the investment necessary to serve the consumer. The reverse side of each bill for motor service bears the regular schedule of rates and a number of suggestions emphasizing the independence of the electric drive, the care of motors, selection of proper motor sizes, desirability of keeping duplicate bearings in hand and the saving in floor space by the use of electricity.

Cost of Periodic Testing of Electric Meters

Periodic testing of electric meters does not necessarily insure a large increase in revenue due to the correction of slow meters, but the company adopting the practice gains the confidence of the public to which it is supplying service, as well as that of the public utility commissions. Especially is this true when the tests are conducted at frequent intervals. Mr. Weare Parsons, of the Springfield (Ohio) Light, Heat & Power Company, read a paper at the recent Ohio Electric Light Association convention, discussing the report of the meter committee of that association, in which he gave some interesting figures on the cost of periodic meter testing as compiled by the company which he represents.

Although periodic tests of meters have been carried on by this company for three years, the data compiled represented the average cost of conducting such experiments during the fiscal year ended Sept. 30, 1912. During that time 2623 meters were tested. This figure represents 71 per cent of the total number installed at the close of the year, or 92 per cent of those installed at the beginning of the year. The cost of testing amounted to $758.31, or 29 cents per meter. At this rate it would have cost $1,100 to test all of the meters, as there were 3829 installed. Of those tested 67 per cent were correct (between 98 and 102 per cent accuracy), 16 per cent were fast, and 17 per cent were slow. The average percentage of accuracy of the slow meters was 93, which means that 17 per cent lacked 7 per cent of being correct in registration. From this figure it was computed that the inaccuracy meant a loss of $3,000 to the company from all of its meters. The correction of fast meters meant a saving of $2,500 to the consumers, or a corresponding loss to the company. Lumping the cost of the test with the saving and loss in revenue due to the correction of the meters, it can be seen that the actual cost of testing was $610, or 16 cents per meter. After a careful investigation of the results shown by the compilation it was decided that a definite amount of time should elapse between tests. The oftener meter tests are conducted the more expensive it is.

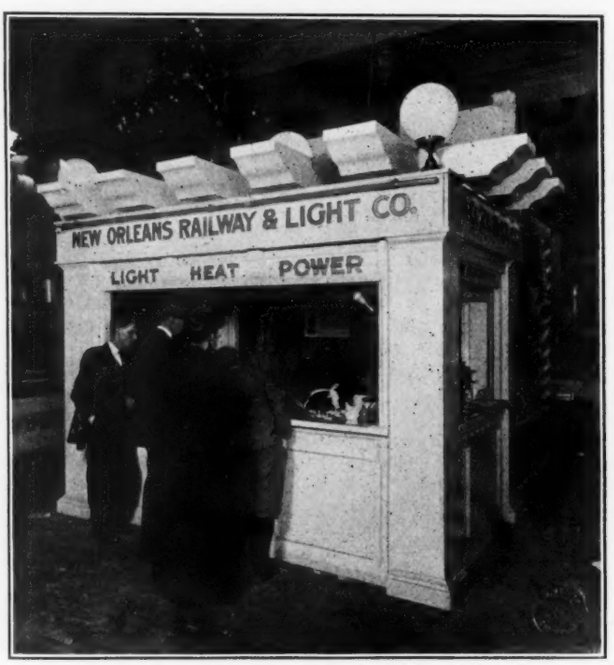
A company that has done little or no testing will be able to pay the expenses of testing from the saving due to the correction of slow meters, as it has been found that meters, in general, register in favor of the consumer. Periodic testing reduces the number of complaints and does not cost nearly as much per test as do the individual tests. Such practice also prevents electric service companies from becoming outlawed where fast meters are found.

Periodic testing often discloses peculiar conditions which might not be found in any other way. Following are some of the instances which were encountered on a periodic testing trip. Jumpers on meters in a grocery store were removed during regular reading periods; one shunt-instrument coil burned out on a polyphase meter, the instrument recording only one-half the load; one shunt transformer burned out on primary installation, the meter recording only one-half the load; meter connected across 110-volt circuit when it should have been measuring 220 volts on the elevator circuit, meter recording only one-half; jumpers concealed in wall, meter recording only when plugs were screwed up; meters found in different degrees of accuracy on account of damaged jewels, etc.

The Public Service Commission of Ohio complimented the Springfield Light, Heat & Power Company on the accuracy of its meters after one investigation.

A Portable Central-Station Exhibit Booth

In the accompanying illustration is shown the portable "knock-down" exhibition booth used by the New Orleans Railway & Light Company at various expositions and fairs where the company is represented. The entire structure is built of light wood with temporary fastenings so that the whole can be dismantled and transferred piece by piece to the next exhibition point. Massive beams of wood which overhang the cornice lend an attractive pergola effect to the booth. The four corners are marked by large frosted balls inclosing tungsten lamps, and the gold-lettered signs on the white walls are illuminated by linolite fixtures extending the length of the four sides. Inside, the booth is attractively fitted up, outlets being provided for attaching electric irons, heaters, stoves, fans and other devices which make up the exhibition of the company's commercial department. Mr. W. E. Clement is contract agent for the New Orleans Railway & Light Company.

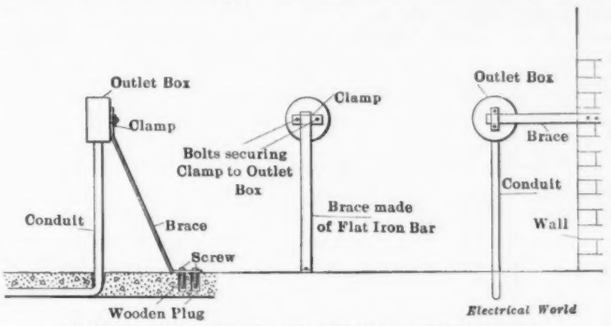


KNOCK-DOWN CENTRAL-STATION EXHIBIT BOOTH

Illumination and Wiring

Support for Outlet Box During Construction

Considerable inconvenience is frequently experienced by electrical contractors from outlet boxes being accidentally knocked out of place during building construction. L. K. Comstock & Company, electrical contractors in Chicago, have reduced this trouble considerably by use of a very simple "made-on-the-spot" device. The device consists of



SUPPORT FOR OUTLET BOX DURING CONSTRUCTION

a brace which can be secured to the floor, wall or ceiling as desired and also to the outlet box. The brace is made out of a rectangular wrought-iron bar bent into the shape shown on the left of the illustration and secured to the outlet box by a clamp. Very little time is required to bend the braces into the desired shape if a form is used, and being simple to install, the device soon pays for itself as it can be used over and over again in different buildings.

A Horse Down a 30-in. Manhole

An extraordinary manhole accident occurred at Rochester, N. Y., recently, when a horse hitched to a heavy truck caught his shoe in a manhole lid, pulling the cover up as he lifted his forefoot. His hind legs then sank through the opening, only 30 in. in diameter, and after many kicks and struggles the animal freed himself from his harness and gradually slipped into the opening until head and forefeet had completely disappeared below the surface of the street. A derrick was summoned, and after much difficulty the horse was hauled out by ropes looped around his neck and front feet. With the exception of a few scratches the animal apparently suffered little from his close contact with a number of 2500-volt cables in the manhole.

Steel-Taped Cable for Series Circuits

A development of the past eighteen months of much importance in street lighting has been the rapidly increasing use of single-conductor lead-covered and steel-taped cable for series street-lighting circuits. Early in 1912 the amount of such cable in use was probably not over a few thousand feet. The reactance caused by the steel-taped covering over a single conductor was feared by many engineers, and it was thought by many that its reactance would be prohibitive for single-conductor cables. A few tests on short working circuits and at the factory, however, demonstrated that these fears were without foundation, and since that time many thousands of feet of such cable have been installed. Probably the largest quantity has been connected with street lighting in Chicago, where a large amount of this cable has been installed in residence districts for supplying energy to 80-cp series tungsten lamps spaced one to every 75 ft. of street on remodeled gas lamp-posts. It is also being used on a number of residence streets at Champaign, Ill.

The importance of this development in underground construction lies in the greatly reduced cost of running substantial series street-lighting circuits underground by this means as compared to lead-covered cable in any kind of conduit buried in concrete. This makes possible underground construction in many districts where before it would have been prohibitive in cost. In residence districts this cable is simply buried about 1 ft. under the surface of the ground in the parkway where digging is easy. Under narrow street intersections and sidewalks in clay it is easy to bury this cable through a hole previously drilled with an auger so that there is very little disturbance of pavements or sidewalks. This, of course, keeps construction costs low.

Another type of construction where this cable is used to advantage is that on Dearborn Street, in the heart of Chicago, where series flame-arc lamps are placed on special brackets at the top of each street railway pole. Conduit construction would have been extremely expensive on a downtown street like this. Exposed lead-covered cables hung in basement space under the sidewalks are liable to damage, as previous experiments with smaller construction in street-lighting work in Chicago has shown. In the recent Dearborn Street work single-conductor steel-taped cable was used, and this was run in the basement space under the sidewalk, with the assurance that the steel tape would afford mechanical protection against disturbance.

Ornamental Tungsten Lighting at Tampa, Fla.

The first cost of installing the present 200 ornamental tungsten lighting standards on Franklin Street, Tampa, Fla., was defrayed by the abutting property owners, who paid for the improvement on the basis of $1.12 per front foot. Extra posts for the street intersections were provided out of the city funds. For the first twelve months the abutting merchants also met the cost of operation of the lighting system, the agreement being that after the first year the city should take over the maintenance of the posts.

Each standard carries four 60-watt and one 100-watt

ORNAMENTAL TUNGSTEN LIGHTING AT TAMPA, FLA.

tungsten lamp. The installation is lighted from dusk to midnight, after which the regular city magnetite-arc lamps (also shown in the accompanying picture) are switched on. Under its five-year contract with the city, the Tampa Electric Company furnishes the service at an equivalent return of 8.25 cents per kw-hr. The cost of installing the present equipment was $6,200, each of the bare posts having cost $30. In addition to the seven city blocks already thus equipped, six more squares are now to be similarly lighted with ornamental standards. Mr. G. H. Wygant is commercial agent for the Tampa company.

Electrolysis in Sockets and Electrical Fixtures

The suggestion that electrolysis due to the use of dissimilar metals in lamp sockets and other electrical fittings is a cause of the destruction and breaking of such parts is made by Mr. A. H. Kennedy, secretary and manager of the electric company at Rockport, Ind. Mr. Kennedy writes as follows:

"We have had more or less trouble with fixtures exposed to the weather, such as primary fuse-plug switches for transformers, sockets and rosettes for porch lamps, street-lamp sockets, etc. I have come to believe that this trouble arises from electrolysis. Usually such fixtures are made of two or more metals through which the current is conducted, the contacts being more or less perfect. Take, for example, the common series film cut-out socket now generally used with the series tungsten lamp. The binding posts are brass, the screws are iron, the two terminals of the socket which hold the film are brass, the two spring terminals of the circuit are copper, the socket is copper and the lamp base is brass. This means that the current has to change from brass to copper six times in passing through one lamp socket. We have also found that the brass parts of switches and other such fixtures exposed to the weather get brittle and go to pieces, which we now believe is also largely caused by electrolysis. This trouble could be completely prevented by making all such parts out of copper, but such sockets as that now before the writer seem to have been contrived actually to encourage electrolytic action."

Recent Telephone Patents

Intercommunicating System

In the combined intercommunicating and exchange system which is now in quite general use there is no means of knowing for what station incoming calls from the exchange are intended. It is therefore necessary that such calls be transferred from the answering to the desired station and provision must be made to prevent the central office from interrupting connections during this transfer period. In systems of this type each station has a bank of keys so that it may be connected to any circuit. When a transfer is to be made, the answering station must not only hold the trunk from exchange, but it must in addition be free to call and converse with the desired station. The improvement described in a patent issued to Mr. L. D. Barrows, of New York City, and assigned to the American Telephone & Telegraph Company lies in this transfer feature, the holding of the trunk being accomplished by a relay. This relay is operated in response to the momentary depression of a holding key, after which actuation it is left in series with the trunk line and with its own contact. It will thus be seen that not only may it be released from the intercommunicating sets, but in case of failure at this end the abandoning of the call by the central office produces a similar result.

New Switchboard System

Two patents have been granted to Mr. F. G. Agrell, of Stockholm, Sweden, relating to a semi-automatic system. According to this system automatic devices connect the calling subscriber to an available connecting cord and set a signal before the operator when a call is originated. The operator responds in the usual way and extends the call manually either to a multiple circuit or to a trunk circuit. The line relays release a motor-driven contact arm. Lying in the path of the revolving contacts on this arm is a set of bars, and the first of these bars which is not in use engages the contacts. This set of bars is immediately drawn back out of the path of any following line contacts. One motor may drive a large number of line contacts and the sets of bars may be exposed to a very large number of lines, providing thereby economy of operation.

Letters to the Editors

Guaranteed Wiring by Contractors

To the Editors of the Electrical World:

Sirs:—As one who has been engaged for many years in the electrical contracting business, I was very much interested in the report of the last convention of the National Electrical Contractors' Association held in Chattanooga, Tenn., particularly in the fact that the association is giving some thought to the subject of guaranteeing the work of its members. Such a step cannot be too highly commended and if carried out will do much to restore confidence in the electrical contracting trade, which confidence has been much abused in the past by unreliable contractors. It has occurred to me that a further step might be taken to advantage, and that one of the large bonding companies might be found willing to furnish bonds for such work at little expense, under suitable arrangements with the National Electrical Contractors' Association. This bond could be made to cover the various local illuminating companies in whose fields the members of the association work. As a rule the electric-light companies in the large cities publish in their bulletins the names of contractors whom they recommend for electric wiring work, and under such a bonding arrangement these lighting companies could not only recommend but guarantee the work of the contractor. Nearly all of the users of electricity look upon the local lighting company as the authority in electrical matters, and if in addition to recommending certain contractors the lighting company could guarantee that the work performed by them would be satisfactory much good would result. I am convinced that this guaranty of the National Electrical Contractors' Association with the further advantage of bonding arrangement would protect the electric-light companies and would work to the advantage of the customer, the contractor and the central station.

I was also very much interested in the matter of uniform bookkeeping and a cost-keeping system. The most unreliable item with which an electrical contractor has to deal is the item of labor, and I would suggest that consideration be given to some arrangement with the trades unions whereby a fixed maximum cost on certain units of work could be determined and the item of labor kept from wide fluctuations. Thus, if the trades union could be induced to specify that the laying of a certain number of feet of conduit in certain types of buildings would constitute a day's work, the most uncertain element in the business will be eliminated.

New York, N. Y. Louis J. Auerbacher.

Strength of Transmission Towers

To the Editors of the Electrical World:

Sirs:—In the article on the transmission-line span over the strait of Ondo Kaikyo, Japan, in your issue dated Aug. 9, Mr. K. Nogami uses the term "safety factor" in reference to structural-steel towers. This term, as he uses it, is misleading and might cause trouble.

The tower, as shown by the photograph and described in his article, would probably collapse under the loads noted in the article, so that the structure as a whole has no safety factor for these loads. The safety factor of 3.4 as determined by Mr. Nogami is the ratio of the ultimate strength of one of the legs in tension to the applied stresses. This member would not fail in tension, but the corresponding leg, which must be in compression, would fail long before the load of 60,000 lb. per sq. in. was reached.

The tower as shown in the photograph has six panels of about equal length, or about 13 ft. A 4-in. by 4-in. angle of this length, without intermediate supports, will not support a load in compression causing as much as 17,000 lb. per sq. in. therein.

Pittsburgh, Pa. J. B. Leeper.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Burners for Oil Fuel—II

BY R. T. STROHM

The Hammel burner, shown in perspective and in section in Fig 1, belongs to the inside-mixing type. It consists of three main parts *a*, *b*, and *c*, held together by bolts *d* and *e*. The lower part *a* contains the passage *f* through which steam is admitted to the burner, and the upper section *b* has the oil connection *g* from which a duct *h* leads downward to a mixing chamber *i* formed by a recess in the under side of the section *c*. The steam flows up from the passage *f* into the chamber *j*, from which three slanting ducts *k*, *l* and *m* lead to the mixing chamber. These ducts are inclined in different directions, and their lower ends are grouped about the end of the oil duct *h* in such a way that the escaping steam will mingle thoroughly with the oil in the mixing chamber. From the mixing chamber a flaring opening *n* extends outward to the tip of the burner, and as the steam flows at high velocity and escapes from the wide orifice *o*, it spreads the oil and causes the burner to produce a fan-shaped flame.

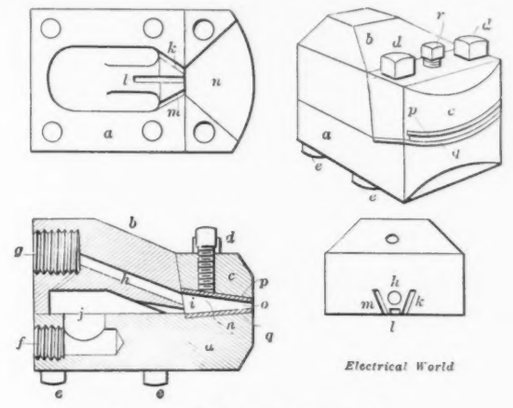


FIG. 1—HAMMEL OIL BURNER

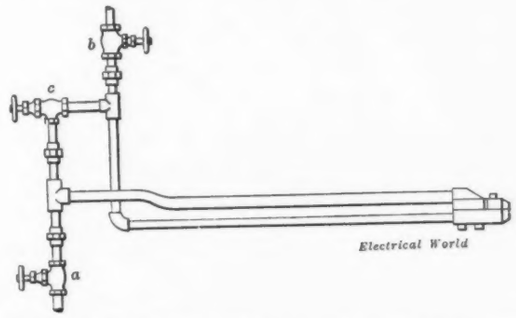


FIG. 2—STEAM AND OIL CONNECTIONS OF HAMMEL BURNER

Experience with steam turbines has shown that steam traveling at high speed has an erosive effect on pipe fittings, valves, vanes and other parts that deflect its motion. This cutting action is present likewise in oil burners that use steam as the atomizing agent, and in the Hammel burner the erosion is greatest in the divergent mouth *n*. The wear is due to the cutting action of wet steam and to the presence of particles of dirt and grit in the oil. As a consequence, the upper and lower faces of the opening *n* are lined with steel plates *p* and *q* that take all the wear and that may be renewed at small cost when they become greatly eroded. To insert new plates, the bolts *d* are unscrewed and the section *c* is removed, thus uncovering the plates. The set screw *r* serves to hold the upper plate *p* firmly in place when the burner is put together.

The Hammel burner is attached to the ends of the steam and oil pipes, as shown in Fig. 2, and these pipes are made of suitable lengths to allow the burner to project into the furnace through the front of the boiler setting. The valve *a* regulates the flow of oil and the valve *b* the flow of steam. The valve *c* acts as a by-pass for use in cleaning out the burner in case it becomes choked with grit or carbonized oil.

A perspective view of the Kirkwood burner is given in Fig 3, and in Fig. 4 is a longitudinal section of the burner, together with the arrangement of the piping. The same reference letter is used to designate corresponding parts that appear in both views. The main part of the burner is a hollow casting *a* into which the steam supply pipe *b* is screwed. A plug *c* is inserted at one end and at the other is a stuffing-box *d* through which the pipe *e* extends into the chamber *f*. At its outer end the pipe *e* is threaded and passes through a threaded collar *g* that may be rotated in the bracket *h* by means of the handle *i*. At the inner end

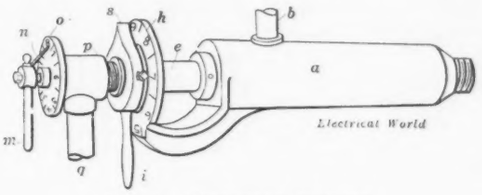


FIG. 3—KIRKWOOD BURNER

the pipe is closed by a plug *j* containing an orifice *k* that may be closed by screwing the long stem *l* inward until it seats against the plug. A handle *m* is fastened to the outer end of the stem and carries a pointer *n* that moves over the dial on the end of the flange *o* on the elbow *p*. The supply of oil is admitted from the pipe *q* through the elbow *p* to the pipe *e*, and it escapes past the regulating stem *l* through the orifice *k*, where it is picked up by the steam flowing into the chamber *f* and carried through the opening *r* into the furnace.

The handle *i* carries a pointer *s* that moves over a dial on the face of the bracket *h*. Movement of the handle *i* governs the position of the plug *k* with respect to the plug *c* and so determines the amount of steam used for atomizing the oil. The position of the stem *l* is regulated by the handle *m*, thus governing the rate of flow of oil. The two dials enable the fireman or the boiler attendant to adjust the flow of steam and oil very accurately after he has once determined the relative proportions that give the best results. By having the regulating valves very close to the point where the steam and oil mingle, as in this burner, the full pressure of each is maintained up to the moment of its escape. The valve *t* is a by-pass valve through which steam may be admitted to the oil pipe to clean it. A slip joint is sometimes inserted in the horizontal section *u* of the by-

pass pipe to allow easy sliding when the oil pipe *e* is moved in or out by the handle *i*. The setting or adjustment of the oil-regulating stem is not affected by the movement of the pipe *e* because the latter is fixed rigidly to the elbow *p* through which the stem passes, so that any movement of the pipe carries the stem along without changing its distance from the plug *k*.

The construction of the Koerting centrifugal spray nozzle

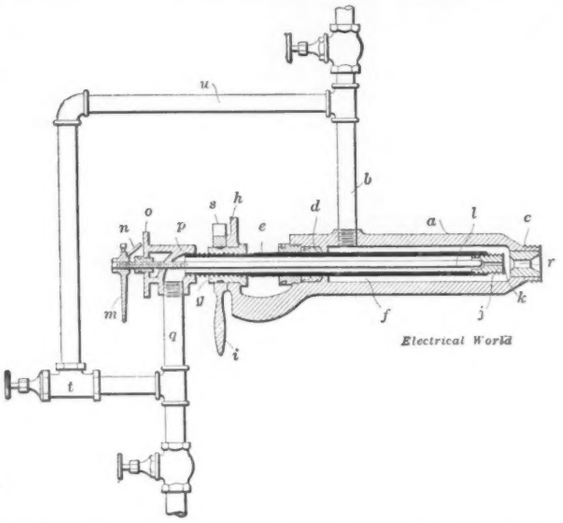


FIG. 4—ARRANGEMENTS OF PIPING FOR KIRKWOOD BURNER

is shown by the section in Fig. 5. The burner consists of a casting *a* that is inserted in a suitable opening in the boiler front and that in turn has an opening *b* through which the tips *c* of the spray nozzles may project. There are two of these nozzles held in the casting *d* that contains the oil passages and strainers. The tip *c* has at its end a small orifice that is expanded inward to form a chamber to contain the screw *e*, which is carried by a stem *f* that fits in the plug *g*, and is held in position by the pressure of the spring *h*. The oil enters through the pipe *i* and passes through the strainer *j* on its way to the spray nozzle, thus being cleaned. The cage *k* that carries the strainer is screwed into the casting *d* and may be taken out for cleaning by first removing the cap *l*. The oil is sprayed by the whirling set up by the screw in the tip of the nozzle, in combination with the pressure maintained in the oil system. The air required for combustion is admitted through registers around the outside of the casting *a*. The stems *f* are held by springs so that, when heated, they may expand freely. If they were held down by the direct pressure of the plugs *g*, any expansion due to heating would cause them

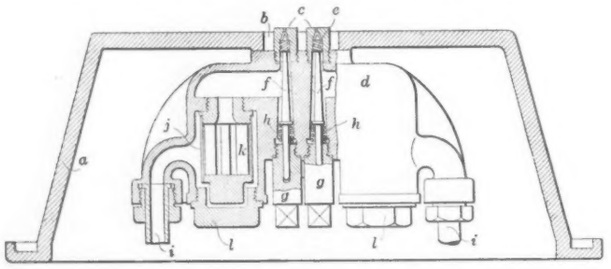


FIG. 5—KOERTING CENTRIFUGAL SPRAY NOZZLE

to buckle. The screws *e* may be removed for cleaning by taking out the plugs *g*.

In all of the types of burners heretofore described the relative proportions of the atomizing agent and the oil are under the control of the operator. The Kirkwood burner shown in section in Fig. 6 belongs to that class in which the relative sizes of the openings for oil and steam or air are fixed during the construction or assembling of the burner. The oil and the steam enter through the pipes *a* and *b*, respectively, which are connected to opposite sides of the body casting *c*. The regulation of the flow of oil and steam is accomplished by turning the single handle *d*, which is threaded on the boss *e* and carries the stem *f*. This stem is hollow and is drilled with lateral holes *g* that connect with the oil supply. At its inner end it is tapered to fit a seat in the plug *h*. A tapered stem *i* is fixed centrally in this plug and projects into the hollow stem *f*. When the handle *d* is turned to the right as far as it will go, the stem *i* closes the duct *j* and at the same time the

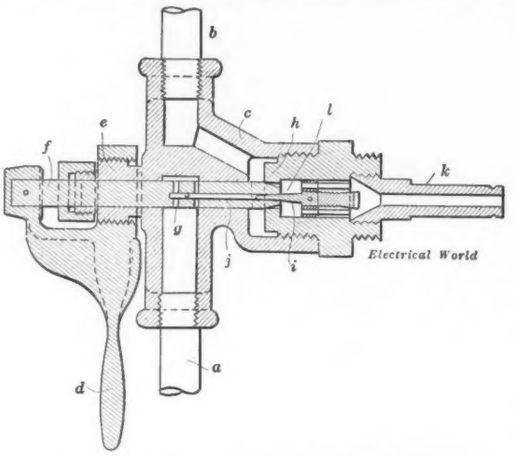


FIG. 6—SECTION OF KIRKWOOD BURNER

tapered end of the stem *f* comes against its seat in the plug *h* and shuts off the flow of steam to the tip *k* of the burner. In this way the burner is shut down. By turning the handle in the opposite direction, both steam and oil are admitted to the mixing chamber *l*, the relative proportions being governed by the taper of the stems *f* and *i*. The position of the stem is fixed by the manufacturer and cannot easily be changed by the operator. This removes the danger of having an unskilled operator affect the efficiency of the burner by changing the relative amounts of oil and steam.

Composition of Non-Corrosive Metal

Will you kindly give the composition of monel metal and its characteristics? E. C. T.

Monel metal is an alloy the composition of which varies. It contains from 67.55 to 69.54 per cent of nickel, 26.25 to 27.53 per cent of copper, 0.17 to 0.44 per cent of carbon and 2.07 to 3.33 per cent of iron, with traces of manganese and silicon. In forged or rolled metal the manganese varies from 1.26 to 1.82 per cent and the silicon from 0 to 0.37 per cent, while in cast metal the manganese varies from 0.09 to 0.49 per cent and the silicon from 1.08 to 1.41 per cent. The carbon appears to strengthen the alloy, but the silicon and manganese do not materially affect its physical properties. Iron hardens, whitens and increases the strength of the alloy, but has a tendency to reduce its elastic limit. The alloy resembles nickel in color; it machines well and takes a high polish which it retains indefinitely. Monel metal melts at 1360 deg. C., has a specific gravity of 8.87 and a hardness number of from 20 to 27 on the Shore scale. Its tensile strength varies from 85,000 lb. per sq. in. when cast to 110,000 lb. per sq. in. when annealed. It is magnetic and absorbs carbon, which can exist in it both free and combined. Monel metal resists corrosion by sea water, superheated steam and chemical solutions about as well as manganese bronze, phosphor bronze and Tobin bronze. It is used in pump cylinders for sea-water and in propellers, rudders, mining screens, valves and plumbing fixtures subject to corrosive influences. Sheets of monel metal are also used for roofing purposes.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Direction of Rotation of Vectors in Alternating-Current Diagrams.—A continuation of the discussion of the two different and opposite definitions of the direction of rotation of vectors in alternating-current diagrams. F. Emde compares the two definitions by discussing side by side the consequences following from both, as to phase displacement in diagrams, symbolic notation by complex numbers, definition of succession of phases and rotating fields. F. Richter discusses the different possible definitions of direction of rotation of vectors and succession of phases in polyphase diagrams.—*Elek. Zeit.*, Aug. 7, 1913.

Theory of Commutation.—C. L. R. F. MENGES.—A theoretical article on the neutral commutation zone. The author endeavors to show that the usual theory of the magnetic commutation zone prevents a clear insight into the facts.—*Elek. u. Masch.* (Vienna), June 29, 1913.

Lamps and Lighting

Double-Filament Incandescent Lamps.—A. BARTH.—For outside lighting it is often desired to reduce the illumination to about one-half of the normal illumination at certain hours of the night. Extinguishing one-half the number of lamps is unsatisfactory, since it produces dark spots. The author has, therefore, developed a system of double-filament incandescent lamps in which one filament gives about double the candle-power of the other filament and the lamp can be easily switched over from each filament to the other or to both together.—*Elek. Zeit.*, July 31, 1913.

High-Pressure Mercury-Vapor Lamps.—A note on a recent British patent (No. 18,372, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. The idle space in the envelope communicating with the arc chamber is filled with solid material so as to reduce the condensation of mercury and thereby increase the pressure of mercury vapor in the lamp.—London *Elec. Eng'ing*, Aug. 7, 1913.

Generation, Transmission and Distribution

Hydroelectric Development in Montana.—MAX HEBGEN.—A long and fully illustrated paper giving a review of water-power development in Montana. Notes are given of the early developments at the Big Hole plant, the Canyon Ferry plant, the Madison plant No. 1 and the Black Eagle plants, and the later developments of the Madison River system, the Missouri River system, the Great Falls system, the Missoula River development and the Big Fork developments. The total generating capacity of the fourteen plants which are now operating on the combined systems of the Montana Power Company and the Great Falls Power Company is 72,100 kw. The principal transmission lines of the combined system operate at 46,200, 66,000 and 100,000 volts. Notes are given on the use of the electricity for lighting and small power purposes, street railways, mining, railroads and irrigation.—*Bulletin Am. Inst. of Mining Eng.*, August, 1913.

Electricity in Mining.—J. B. FISKEN.—A paper on the application of electrical energy to mining in the Cœur d'Alene district. A map shows the development of the Washington Water Power Company's system in that district. In 1903 there were seven substations, with a total transformer capacity of 3350 kw. To-day there are eleven substations and a transformer capacity of 13,900 kw. The original plan followed was to step from 60,000 volts to 2300 volts in each substation and to have substations at frequent intervals; the practice now is to install fewer and larger substations and to have each substation serve a larger territory. The result is achieved by using a distribution circuit of 6900 volts from the substations and stepping down with open air-transformers to 2300 volts at the customer's plant.—*Bulletin Am. Inst. of Mining Eng.*, August, 1913.

Traction

Driving Submarines.—In the course of a long paper on the development of submarines and submersibles and their propelling equipment, G. Berling deals with several matters of electrical interest. Usually, submarines are driven on the surface by oil engines, which also during such cruising periods drive dynamos charging a large storage battery. When the vessel runs submerged the dynamos are driven as motors from the battery and the oil engines are shut down.—From 1913 "Jahrbuch der Schiffbautechnischen Gesellschaft," abstracted in London *Elec. Review*, Aug. 8, 1913.

British Tramways.—A. J. LAWSON.—The first part of a statistical article in which an analysis is given of the financial position of the tramways of the United Kingdom, the items examined being capital expenditure, cost of construction and equipment, traffic, revenue, appropriation, aid from rates, relief of rates and costs.—London *Electrician*, Aug. 8, 1913.

Mountain Railway.—A. GRADENWITZ.—An illustrated description of the Villefranche-Bourg Madame electric railway in the French Pyrénées. Water-power is utilized, the direct-current system being employed with a third-rail at 850 volts.—London *Elec. Review*, Aug. 8, 1913.

Electric Railways.—E. E. WACHSMANN.—An article on the electrification of main railways in the Northwest of the United States with special reference to the Puget Sound Railway and the Butte-Anaconda line.—*Elek. Zeit.*, July 31, 1913.

Electric Automobiles.—J. W. BAUCHAMP.—A general discussion of the electric vehicle, its limitations and selling points for the English market.—London *Elec. Review*, Aug. 8, 1913.

Installations, Systems and Appliances

Three-Wire Direct-Current Systems.—A. LAUTEREN.—In many cases the necessary cross-section of the neutral wire in a three-wire system is not calculated with sufficient accuracy, so that with unequal load on both halves of the system there will be too high a current in the neutral wire and too great a difference between the voltages in the two halves. In order automatically to insure that the voltages in the two halves are equal it is proposed to insert a dynamo (neutral booster) in series in the neutral wire. This booster produces an emf which in every instant equals the current in the neutral wire multiplied by the sum of the resistance of the neutral wire plus one-half the resistance of the outer wires. Even under unfavorable conditions the dimensions of such a booster are small, so that it is an inexpensive means of insuring equality of voltage in the two halves of the network. The author finally discusses such networks in which two boosters are provided in the two outers in order to make up for the voltage drop in the two outers. In this case equality of the voltages in the

two halves is obtained if the two boosters are compounded in such a way that the current in the neutral wire excites the compound windings. The compound windings of the two boosters act in the opposite direction, the arrangement

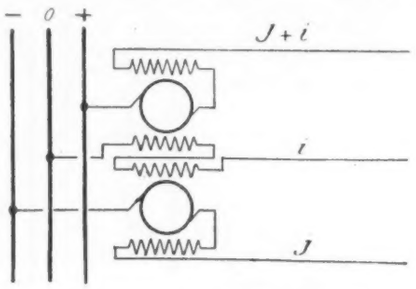


FIG. 1—ARRANGEMENT OF COMPOUND WINDINGS

being shown in Fig. 1.—*Elek. u. Masch.* (Vienna), July 20, 1913.

Rates for Energy in the Austrian Central Stations.—L. ROSENBAUM.—A statistical article on the different tariffs in use in Austrian central stations. The following table gives a review of the different systems of tariffs:

	Number of Stations	
	Energy for Lamps	Energy for Motors
Meter tariff without discount	179 (140)	142 (118)
Meter tariff with discount	167 (79)	178 (80)
Double tariff	8 (6)	12 (6)
Flat rate	240 (164)	158 (98)
Mixed meter tariff and flat rate	142 (102)	110 (78)
Total	736 (491)	600 (380)
Data not available	118 (81)	254 (192)
Grand total	854 (572)	854 (572)

The greater figures relate to Jan. 1, 1913, while the figures in parentheses relate to 1909. It is seen that the stations with meter tariff and discount and the plain flat-rate stations have shown the greatest increase since 1909. The stations using the flat rate employ water-power almost exclusively, while those with a meter tariff are mainly fuel-fired. The stations with mixed tariff are of about equal parts pure water-power stations, pure fuel-fired stations and water-power stations with a fuel-power plant reserve. Other tables give data on the rates charged for lighting and power, discounts allowed, etc.—*Elek. u. Masch.* (Vienna), July 6, 1913.

Wires, Wiring and Conduits

Electricity Supply Charges.—An anonymous article giving a series of curves, the chief object of which is to give the engineer who is canvassing for a supply the means to lay before any prospective consumer an approximation of his expenditure for a supply of electricity per annum and his average price per unit on any estimated consumption (in the event of the scale of charges for supply not being based on a flat rate), and also a graphic illustration of the fact that "the more electricity the consumer uses, the cheaper it becomes to him, and therefore the more he can afford to increase the use of a supply when once installed." —London *Elec. Review*, Aug. 1, 1913.

Capacity and Voltage Drop in Three-Phase Lines.—G. P. MARKOVITCH.—A long mathematical article on the calculation of the capacity and the voltage drop in high-tension overhead three-phase lines whether balanced or unbalanced. In the calculation of the voltage drop the charging currents due to the capacity are taken into account.—*Elek. u. Masch.* (Vienna), June 22 and 29 and July 20, 1913.

Transmission-Line Calculations.—HANS GRUENHOLZ.—A mathematical article on the calculation of the poles for transmission lines with suspension insulators.—*Elek. u. Masch.* (Vienna), July 6, 1913.

Electrophysics and Magnetism

Magnetic Properties of Alloys.—G. GOLDBERG.—The author emphasizes that Weiss' theory of the magnetic structure of molecules and atoms is on a sound basis and is well adapted to the study of the magnetic properties of alloys.—*Elek. Zeit.*, July 31, 1913.

Units, Measurements and Instruments

Ampere-Hour Meter for Alternating Current.—J. BUSCH.—The curved form of the magnetization curve of iron has been a disadvantage for measuring instruments as it disturbs proportionality, but there are cases where this disturbance of proportionality can be made use of. Such a case is, for instance, an ampere-hour meter. The action of current and its field (without any auxiliary independent field) upon a moving body is under normal conditions proportional to the square of the current, and in order to obtain proportionality between speed of rotation and current consumption it would be necessary to use some system of air damping or liquid damping. But these methods have various disadvantages. However, damping by means of permanent magnets has proved very successful. The problem is now whether it is possible by employing high magnetic saturation to accomplish that when a permanent damping magnet is used the proportionality between current consumption and speed of rotation may be obtained within certain limits. The magnetization curve has a certain similarity to the curve $y = \sqrt{x}$, and this familiarity is used by the author for the design of an induction ampere-hour meter for alternating current by proper selection of the dimensions of iron. It is indeed possible to obtain satisfactory proportionality from one-tenth full load up to double full load. The author has built meters of this type for 1 amp, 200 to 250 volts, and for 2 amp, 100 to 130 volts. —*Elek. Zeit.*, July 31, 1913.

Telegraphy, Telephony and Signals

Time Signals in Wireless Telegraphy.—H. THURN.—An illustrated account of the different wireless telegraph receivers which are permitted by the German government for receiving time signals from the Norddeich station. The signals have a wave-length of 1600 m. The government has a right to forbid the use of unsuitable receivers. The

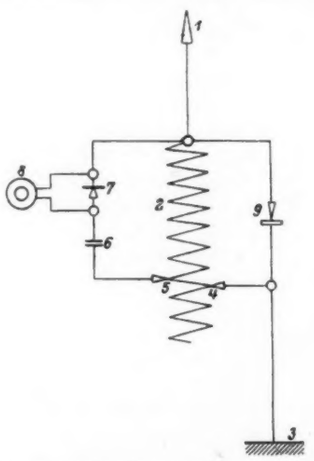


FIG. 2—SUITABLE WIRELESS RECEIVER FOR TIME SIGNALS

article describes four or five permitted receivers, of which two are reproduced in Figs. 2 and 3. Fig. 2 represents a receiver for time signals and weather telegrams for the special use of watchmakers, etc. 1 is the antenna, 2

is the receiving coil, 3 the earth, 6 a condenser, 7 the detector, 8 the telephone, while 9 is an auxiliary contact which is open while time signals are received and closed when the apparatus is not used, since it earths directly the

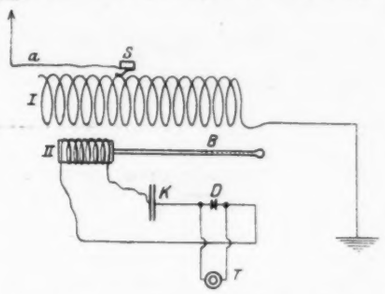


FIG. 3—TIME-SIGNAL RECEIVER WITH PRIMARY INDUCTION COIL

antenna and protects the apparatus from air-electric discharges. Fig. 3 shows another time-signal receiver, which contains a primary induction coil *I*, one end of which is earthed, while the sliding contact *S* is connected to the antenna. By means of the sliding contact the station is tuned to the wave-length received. Within the primary coil *I* there is a secondary coil which can be pushed in more or less by means of the rod *B*, so as to adjust the degree of coupling. The active windings are those between the sliding contact and the earth connection. The secondary coil *II* is in series with a condenser *K* and the contact detector *D*, which is in parallel with the telephone *T*.—*Elek. Zeit.*, July 24, 1913.

Influence of Cable Inductance Upon Duplex Balances.—GEORGE WALD.—The tendency toward higher speeds in submarine cable working has necessitated instruments whose moving coils have smaller periods than formerly. The instrument thereby becomes enormously sensitive to rapid disturbances, such as occur during the first few thousandths of a second when a signal is sent into a duplexed cable. A great deal of this disturbance may be traced to the inductance of the cable and the absence of, or really comparatively negligible value of, the inductance of the artificial line, owing to its "zigzag" construction. The author discusses the influence of cable inductances from a mathematical point of view and shows, first, that the current entering an artificial line on the direct application of a battery of negligible resistance is infinitely great at the first instant and then falls in value inversely as the square root of the time. In the case of the cable the commencing current is limited to $e/(Lv)$, the cable behaving as though it had a commencing resistance Lv ohms, where $v = 1/\sqrt{LS}$, L the inductance and S the capacity in farads per naut. If it were possible to have a differential duplex system with the limitations of no sending resistance or capacity, there would be an infinite disturbance at the first instant, though only of appreciable magnitude for the first few thousandths of a second. This is obvious, as the difference of the two currents is the disturbance in differential duplex. Later the disturbance reverses and gradually becomes zero. This effect is clearly shown in a series of diagrams. It is pointed out that a difference of the order of volts may exist across the receiving instruments for a few thousandths of a second. If the assumption of negligible inductance in the artificial line is correct, a duplex balance is maintainable only by reason of the dissonance between the instrument and these rapid disturbances.—London *Electrician*, July 25, 1913.

Dalmatia Incorporated Within the Austrian Telephone System.—E. F. PETRISTCH.—In order to include the province of Dalmatia in the Austrian telephone system it was necessary to make connections by means of several submarine cable lines in series with overhead telephone lines. For the overhead line a bronze wire of 5 mm is used. For the submarine cable sections a continuously loaded cable of the Krarup system is employed. It was concluded that for this purpose continuous loading by the Krarup system was technically as efficient as discontinuously loading with Pupin coils, but the former system was found to be the cheaper one and was therefore adopted. Details of the line are given, and it is emphasized that the whole system has proved very satisfactory.—*Elek. u. Masch.* (Vienna), July 6 and 13, 1913.

Wireless Telegraphy.—E. NESPER.—An illustrated description of some new developments of the Marconi system, especially the transmitting arrangements and the equipment of several new Marconi stations.—*Elek. Zeit.*, July 31, 1913.

Miscellaneous

German Association of Electrical Engineers.—The first parts of a detailed account of the proceedings at the recent Breslau meeting and a verbatim account of the discussions (but no report of the papers themselves, which are printed elsewhere).—*Elek. Zeit.*, July 31 and Aug. 7, 1913.

Book Review

PRACTICAL PHYSICS FOR SECONDARY SCHOOLS. Fundamental Principles and Applications to Daily Life. By N. Henry Black and Harvey N. Davis, Ph.D. New York: The Macmillan Company. 488 pages, 465 illus. Price, $1.25 net.

The student who acquires and assimilates the facts, principles and applications of physics, as presented in this book, will be exceptionally well equipped for taking up more advanced courses in science or engineering, and even if he should not follow a career requiring exact scientific training and methods of thought, he will at least have a working knowledge—elementary perhaps, but not superficial—of the fundamental laws which underlie all happenings in the world of material things. Our modern civilization is such that the man without this knowledge is necessarily handicapped and "behind the times." The extent of the ground covered by the authors in this book of 488 pages is enormous; the manner in which it has been done is almost wonderful, and they deserve nothing but praise for the methods they have adopted and the consistent way in which they have carried out their purposes. From the simplest laws of mechanics the reader is led to an accurate presentation of velocities, accelerations, momentum and the principle of the conservation of energy. Then follow heat, magnetism, electricity, sound and light, the last chapter of all treating of electric waves and Roentgen rays. The language used throughout is simple, terse and accurate, and—owing partly to the method of presentation, but also to the frequent introduction of examples and illustrations from everyday life—the interest is aroused and kept from flagging. The numerous illustrations and cuts are excellently well adapted to their purpose; they are well drawn and clearly reproduced, representing what the authors wish to represent—no more and no less. The book is undoubtedly original, and it represents much conscientious work. It is very far from being a compilation of cuttings from other textbooks—a most refreshing feature in a treatise of this class. At first sight it would seem that the boy of the secondary schools is expected to know a great deal, and in fact that the subject —notwithstanding the lucid manner of its presentation—is carried rather too far. This criticism might well be made were it not that the authors have taken pains to explain in their preface that the material they have selected—after careful exclusion of what they deem unnecessary—is probably more than any class could undertake to study adequately in a single year. They suggest that the teacher adapt his instruction to the local needs of his class and the time available.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Toy Transformer

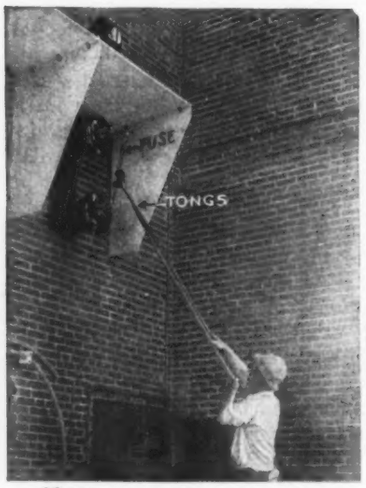
For the boy who is fond of experimenting with electricity the Thordarson Manufacturing Company, of 508 South Jefferson Street, Chicago, Ill., has developed for the market a toy transformer, in which the secondary is equipped with three taps, enabling 3, 6 or 9 volts to be taken off. Care has been taken to render this transformer

TOY TRANSFORMER

indestructible. It is inclosed in a steel case and immersed in an insulating compound that makes it impervious to moisture. Each transformer is equipped with a plug and a supply of flexible cord so that it may be attached to any alternating-current lamp socket.

66,000-Volt Substation Fuses

Among the recent developments in high-tension circuit-interrupting devices, the chemical fuse has shown successful operation under severe conditions. An installation for use on 66,000-volt systems is shown in the accompanying illustration. This particular installation is used to protect a three-phase substation taking energy at 66,000 volts and transforming it to lower commercial potentials. The illustration shows one phase of a three-phase service and also the method of handling the glass tube fuses by means of insulated tongs. It is said that 5-amp, 66,000-volt fuses have been blown under heavy short-circuit conditions on a feeder which had behind it a generating capacity of 27,000 kva.



66,000-VOLT, 5-AMP CARBON-TETRACHLORIDE FUSE

This protective device is being manufactured by the Delta-Star Electric Company, Chicago. Its cost is said to be much less than that of oil circuit-breakers or switches.

Motor-Driven Cream Separator

The illustration herewith shows the facility with which electric drive can be applied to a tubular separator, which will yield in different sizes of the same-type machine up to 950 lb. of butter per hour. Separation is accomplished by centrifugal force primarily exerted by a separator bowl or cylinder which revolves at a high rate of speed. A 0.25-hp,

DIEHL CREAM SEPARATOR

1725-r.p.m. compound-wound open-type motor is used to drive the separator, but the motor may be readily disconnected and the handle thrown to mesh if hand operation is preferred.

This motor-driven separator is manufactured and sold by the Sharples Separator Company, West Chester, Pa., the motor supplied being the product of the Diehl Manufacturing Company, Elizabeth, N. J.

Electric Heater for Automobile Radiators

The use of an electric heating unit for heating an automobile radiator during the winter months when the engine is not in operation is a novel application as well as one of practical significance. Patents on such an application have been allowed Mr. William Gallaher, of the Laclede Gas Light Company, of St. Louis. One of the original units which was made for Mr. Gallaher is shown in the accompanying illustration. The device consists of an ordinary heating cartridge inclosed in a copper shell 0.375 in. in diameter and 2.25 in. long, which is sweated into the lower part of the radiator as shown in the cut. A flexible cord connects the heating unit with the dashboard, where a

plug receptacle can be installed which may be connected to an incandescent-lamp outlet when the automobile is standing in the garage. If the car is provided with an electric-starting apparatus, these plugs can be furnished with two distinct heating coils—one for use on electric-

FIG. 1—FLEXIBLE CORD AND PLUG FOR ELECTRIC HEATER

lamp circuits and the other for use on the storage-battery circuit.

Experiments were conducted with one of these attachments, and it was decided that a 25-watt unit would generate sufficient heat in the winter provided the radiator is covered with a blanket. The conclusion obtained above is on the assumption that the tank holds about 3 gal. of water and that the owner of the automobile wishes to conserve as much heat as possible. Attempts have been made by some owners of automobiles to keep their radiators from freez-

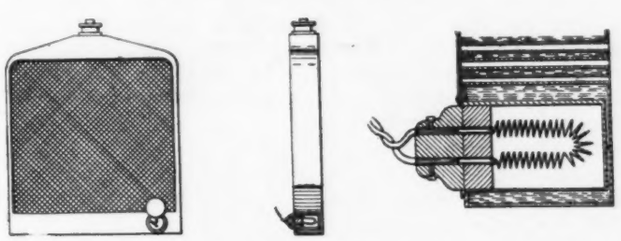


FIG. 2—ELECTRIC HEATER FOR AUTOMOBILE RADIATORS

ing in the winter by placing a luminous electric heater in the garage near the car, but the method is uneconomical and sometimes ineffectual.

Indirect-Lighting Units with Detachable Bowls

The new building of Butler Brothers, which fronts on Randolph and Canal Streets, covers one city block, is fifteen stories high and is the largest warehouse in Chicago. Fig. 3 shows the general offices on the main floor, which measure 150 ft. by 170 ft. The area of 25,500 sq. ft. is divided into seventy-two bays, which are illuminated by means of 288 100-watt indirect units equipped with X-ray reflectors. Some idea as to the diffusion of the light and the general uniformity of the resultant illumination may be obtained from Fig. 3. A gross energy allowance of 1.5 watts per square foot of area illuminated has been made in carrying out the lighting scheme.

The type of unit used in this installation is shown in detail in Fig. 2. The outer brass spinning for supporting the silvered reflector is finished in what is known as "egg-shell" white (a matte-white washable enamel). The pendent socket and the canopy are finished in a similar manner,

FIG. 1—LIGHTING UNIT SHOWING HOW BOWL IS DETACHED

FIG. 2—LIGHTING UNIT EQUIPPED WITH X-RAY REFLECTOR

and the reinforced lamp cord is manufactured in the same color.

The construction of the lower brass spinning is such that for the cleaning of the reflector any of the supporting arms can be readily detached, as shown in Fig. 1. The reflector and lamp need not be removed from the fixture, and as these reflectors can readily be cleaned by merely wiping them with a damp cloth, cleaning labor is reduced to a minimum.

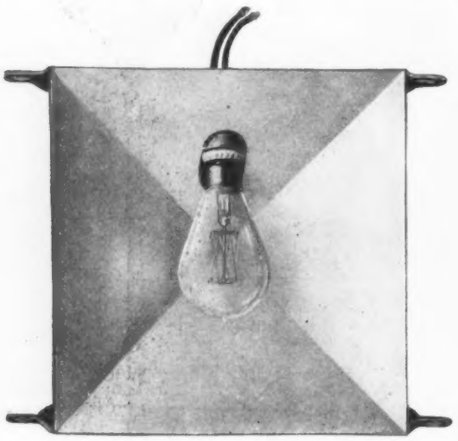
Altogether, 1600 units of the type here described, which

FIG. 3—MAIN FLOOR

were furnished by the National X-Ray Reflector Company, of Chicago, Ill., are installed in the various offices and salesrooms of this building, and the illumination thus secured is said to be highly satisfactory.

Wall Reflector for Bulletins and Signs

The Reynolds Electric Flasher Manufacturing Company, Chicago, Ill., is placing upon the market a specially designed reflector for painted walls, bulletins, billboards and signs. The reflectors are supported by wire cables, which in turn may be fastened to cross-arms at the top and bottom of a sign. The reflector contains a 100-watt tungsten lamp placed so that the light is evenly distributed over 15 sq. ft. of sign surface.



WALL REFLECTOR FOR BULLETINS AND SIGNS

The reflector, made of porcelain-enameled steel, has a glassy, white reflecting surface on the inside and is blue on the outside. This material is practically indestructible and requires no repainting.

Switchboard Signaling in the World's Largest Power Station

In the world's largest power house, the Keokuk generating station of the Mississippi River Power Company (described in the *Electrical World*, May 31, 1913), it is more than 800 ft., or nearly one-sixth of a mile, from the switchboard to the most remote generator, and no part of the generator room is visible from the switchboard owing to the fact that the latter is installed in an upper story. For this reason no efforts were spared to make the signal system as dependable as possible, a novel principle of operation being employed.

The transmitter of the switchboard set is operated from a handle, pointer and dial, mounted on the front of the benchboard and concentric with the field-rheostat hand-

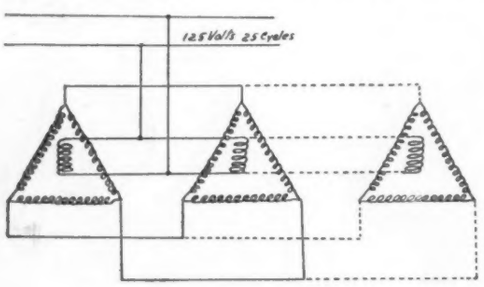


FIG. 1—DIAGRAM OF CONNECTIONS

wheel of the corresponding generator, the motion which sets the pointer of the transmitter being communicated by a cable. Synchronous movement of the pointers of the transmitter and receiver is accomplished by means of small induction motors, each provided with a three-phase delta-connected stator winding and a single-phase rotor winding of the shuttle type. Each pair of stator windings is connected in multiple, but these windings are not excited except by induction from the rotors, which are in turn excited from a 25-cycle, single-phase source. With two motors connected thus, any motion of the rotor of one is accompanied by a corresponding motion of the rotor of the other, so that both will always bear the same relative position to

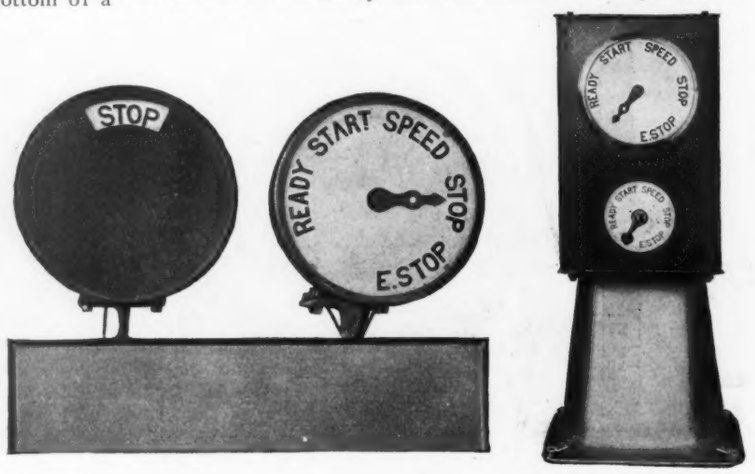


FIG. 2—CONTROL INSTRUMENTS

their stator windings. Provision is made for automatically throwing the rotors across an auxiliary supply circuit in case of failure of the main source.

To send a signal, the switchboard operator turns the handle to the proper position, this action moving both the pointer on the transmitter and that on the receiver, so that both point to the signal division. He then pushes a button, lighting a lamp at the generator whose operator is being signaled to and also blowing a whistle in order to attract attention.

As soon as the machine operator has read the signal, he turns his transmitter to the same position, transmitting the signal back as a check. Then he presses a button at the right, extinguishing the lamp and cutting out the whistle; after which he presses a button at the left to light a lamp in the switchboard room and ring a bell to attract the attention of the operator there. The latter, after checking the signal, presses the button at the left of his own handle, extinguishing the lamp and cutting out the bell, which in this way completes the sending and checking of a signal.

The apparatus which is outlined in this article was manufactured at the works of the General Electric Company, Schenectady, N. Y.

The Horschitz Slip Meter

With the meter illustrated herewith, which has been developed for determining the slips of induction motors, measurement is made of the secondary frequency directly in terms of the primary frequency, from which the slip is ascertained at once.

This apparatus is constructed in the form of a revolution counter, and consists of a cylindrical aluminum body which contains a simple mechanism—a removable steel contact point and a handle. The cover has two openings, which bear the inscriptions "R" (revolutions) and "O" (oscillations) respectively, and ten round openings, or five pairs of openings, each pair being designated by its respective pole number. Special plugs with springs fit into these last-named openings. These plugs are attached to two conductors which have lugs on the other end for connection to the instrument transformer which is furnished with each outfit. This is a single-phase transformer having a secondary emf of 10 volts, so that the instrument receives only

this small voltage. The primary of the transformer is divided into twelve steps of 50 volts each, making a total range of 600 volts. When using the slip-meter on voltages between these steps, the next lower range is used, the instrument not being affected by small voltage variations. The primary of the transformer is equipped with a switch and fuses. For higher voltages any convenient transformer may be used.

The method of making a measurement is as follows: The primary coil of the transformer is connected to two wires of the supply circuit. The secondary coil is then connected to the two conductors with the plugs, which are introduced into the respective sockets of the apparatus, that is, into the sockets the numbers of which correspond with the number of poles of the motor under test. From differences in the readings of "R" and "O" taken both before and after pressing the slip-meter against the end of

FIG. 1—HORSCHITZ SLIP-METER, READY FOR USE

the induction motor shaft, the slip is determined by a simple ratio formula.

The theory of the apparatus, briefly stated, is as follows: Two slip-rings and a commutator, having as many segments as the motor has poles, are connected with the shaft of the motor. The brushes of the two slip-rings are connected to the terminals of the motor, and the segments of the commutator are alternately connected with the two slip-rings. The two brushes of the commutator are placed at a distance of one segment apart and are connected with the windings of a double-T armature which swings between the poles of a permanent magnet.

If the motor should run in synchronism, the alternating current supplied to the commutator would be rectified during each half-wave. This rectified current would have a constant average value to which a certain deflection of the armature would correspond. This deflection would be dependent upon the momentary position of the rotating commutator with respect to the brushes and the wave of the supply voltage at the time when the motor came into synchronism.

If, however, the motor does not run in synchronism, the rectification will occur later in each succeeding period, have a different average value, and cause the double-T armature to assume a different position. The armature will slowly swing from a positive indication, through zero, to a negative indication and return. It therefore follows that the ratio of the number of swings or oscillations of the armature per second to the frequency will be equal to the slip. The frequency is determined from the speed and the number of poles, the mechanical arrangement being such

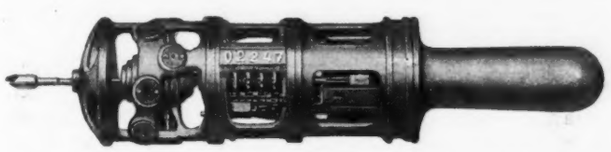


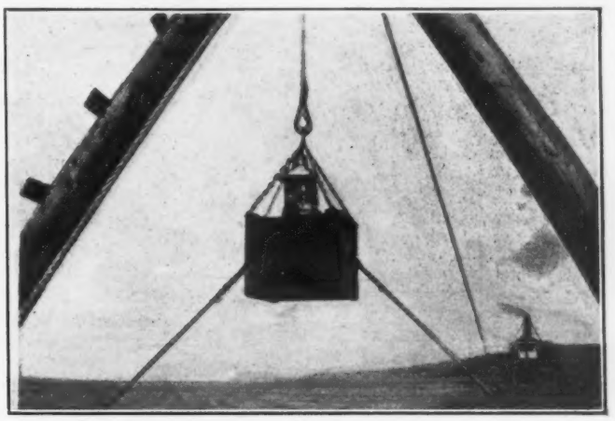
FIG. 2—HORSCHITZ SLIP-METER WITH CASING REMOVED

as to correspond to a two-pole model. There are five commutators with two, four, six, eight and ten segments, so that tests can be carried out upon motors with different numbers of poles.

This device has been placed on the German market by Siemens & Halske, Berlin, and on the American market by James G. Biddle, 1211 Arch Street, Philadelphia, Pa.

Storage-Battery Raft Lamps on the Columbia River

In accordance with government regulations on the Columbia River, the large log rafts can be towed down the river only at night on account of interference with navigation in the daytime. For the purpose of safety these rafts must be equipped with fore and aft lamps. The accompanying illustration shows an installation where lamps are placed directly over a case containing the batteries, doing away with practically all wiring. The outfit is equipped with two 4-cp lamps wired in parallel, and the battery consists of two 6-volt batteries having a capacity of 100 amp-hr.



ELECTRIC RAFT LAMP

This electric raft lamp was designed by the Astoria Hardware Company, of Astoria, Ore., and the batteries were furnished by the Electric Storage Battery Company, of Philadelphia. The arrangement keeps the batteries at a considerable height above the raft, where there is no danger of their being washed over by heavy seas. It is said that this scheme has been used for some time and has given satisfactory service.

Special Attachment Plug for Heating Apparatus

The Hotpoint Electric Heating Company, Ontario, Cal., is manufacturing a plug especially designed to withstand the severe service imposed upon heating apparatus. The plug is extra long so that it may be easily screwed into a lamp socket when there is a reflector on the fixture. The hard-rubber grip is large and deeply knurled, affording a firm grip. The grip interlocks with the porcelain core, which in turn fits into a rectangular slot, with long parallel sides, in the screw-shell. The conductor ends are securely

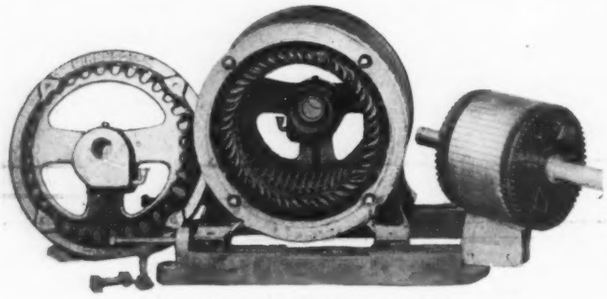
SPECIAL ATTACHMENT PLUG FOR HEATING APPARATUS

anchored, allowing little probability of short-circuits. There is plenty of knot room for the cord, and the hard-rubber grip has a wide bell, with easy curvature, where the cord enters.

The screws that hold the three parts together fasten into nuts molded within the hard-rubber grip. These screws receive none of the strain incidental to turning the plug.

Alternating-Current Motors

A new line of alternating-current motors has been put on the market by the Electric Machinery Company, of Minneapolis, Minn. The motors are made in three types, namely, squirrel-cage low-resistance rotor, squirrel-cage high-resistance rotor and slip-ring phase-wound motors. Special attention is given to particular applications such as



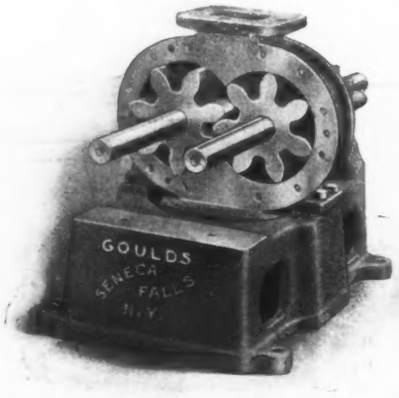
ALTERNATING-CURRENT MOTORS

to elevator and hoist duty where especially high torque starting characteristics are required. A great many conditions are met with the standard squirrel-cage type of motor with a special rotor giving it the same heavy starting characteristics as the slip-ring motor but eliminating the extra cost of slip-rings and also the attention they require. For variable-speed service, such as with cranes, ventilating fans, etc., where different degrees of speed are required for continuous operation, the standard form of slip-ring motor with phase-wound rotor is provided.

Rotary Pump with Gear Impellers

A new type of rotary pump has been developed by the Goulds Manufacturing Company, Seneca Falls, N. Y. This pump differs from the ordinary rotary pump of the same capacity in that gear-style cams have been substituted for the three-toed cams and the gears on the end of the cam shafts have been eliminated.

The pumps are built in two sizes, one of which has a rating of 25 gal. to 50 gal. of water per minute at 225 to 450 r.p.m., and the other has a rating of 50 gal. to 100 gal. per minute at 225 to 450 r.p.m.



ROTARY PUMP WITH GEAR IMPELLERS

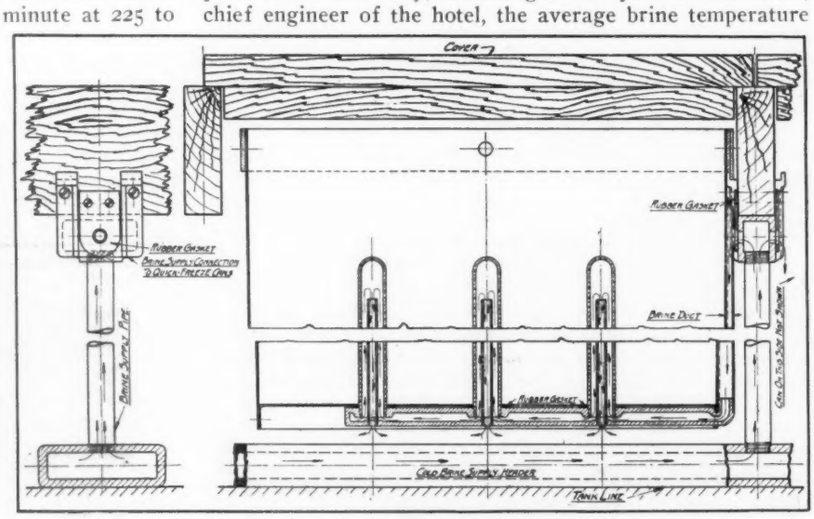
Both types of pump are mounted on cast-iron bedplates, fitted with outboard bearings and tight and loose pulleys for belt drive. One type of pump has two discharge openings and the other has three discharge openings. The pumps are provided with 3-in. and 4-in. suctions and 1.5-in. and 2-in. discharges respectively in the two styles.

Twelve-Hour Ice-Making Process for Central Stations

With the improved freezing-can construction illustrated in the accompanying sketch it is declared that 300-lb. cakes of ice can be made in twelve hours, using brine at 10 deg. Fahr.—features which are of special interest to the central-station contemplating the installation of off-peak ice-making equipment. This saving of time is made possible with brine at ordinary temperatures since in the cans illustrated freezing of the distilled water proceeds both from the outside walls of the can and from the brine-circulating pipes within the can. These latter double pipes are connected in multiple to a manifold on the bottom of the can, the cold brine passing first upward through the annular space between the pipe walls and then downward through the smaller interior pipe which discharges out into the brine tank in which the cans are immersed. The brine thus first chills the central pipes and then passes on to the tank contents to produce freezing from the outside walls of the can. Freezing takes place in both directions within the can, thus greatly accelerating production of the finished cake of ice.

The construction diagrammed in the illustration is that used for plants in which the ammonia-expansion coils are immersed in the freezing tank. The standard construction recommended by the designers, however, utilizes expansion coils or shells at a point remote from the freezing tank. The freezing tank is divided into a number of compartments, insulated from each other. In this way, while freezing is proceeding in several of these sections, the brine in the one where freezing has been completed is being warmed in the forecooler or exchanger operated with the remainder of the plant, so that ice in the finished section is meanwhile being thawed free of the cans without loss of refrigeration. The freed cakes of ice are then ready to be lifted from the cans, which remain fixed in the brine tank.

To demonstrate the practical operation of this "quick-freeze" system in producing twelve-hour ice with 10-deg. brine a test was recently run at the Hotel Empire, New York City, where a 10-ton plant with thirty-five 250-lb. Parsons "quick-freeze" cans is installed. Filling a can with 74-deg. (Fahr.) raw unfiltered water at 9:30 a. m. Aug. 21, the 250-lb. cake of ice was solidly frozen by 9:30 p. m. of the same day, according to Mr. John Fitzsimmons, chief engineer of the hotel, the average brine temperature having meanwhile been 8.5 deg. Fahr. and being held steadily at 10 deg. during the last seven hours.



SECTION THROUGH QUICK-FREEZING ICE CAN

The ice produced in this way is practically without core, and the can equipment is reduced to half that required for twenty-four-hour freezing.

The Parsons Quick-Freezing System is marketed by the United Ice Improvement Company, Marbridge Building, New York City.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Good Fan Season Reported.—The Hunter Fan & Motor Company, of 114 Liberty Street, New York, made an increase of about 16 per cent during the first six months of this year over the sales for the corresponding period of 1912. This company makes a specialty of ceiling fans, but it handles also a line of portable fans.

Lamp Factory Located at Ampere, N. J.—The Howard Miniature Lamp Company, formerly located at Academy Street, Newark, N. J., has moved into its new factory at Ampere, N. J. The building occupies a ground area of 172 ft. by 75 ft. and is two stories in height, of slow-burning mill construction. It is light and airy and has provision for a lunch room for the accommodation of employees. The capacity of this new plant is 20,000 lamps a day.

Indiana Manufacturer Equipping New Factory.—The new factory of the Duncan Electric Manufacturing Company at Lafayette, Ind., is completed and the new machinery is being installed. This addition to the present works will permit of an increase of 100 or more in the working force. The company is experiencing a heavy sale in its various lines of house-type, switchboard-type and portable-type direct-current and alternating-current watt-hour meters and transformers.

Generating Station Equipment Ordered.—Orders for generating equipment, converters, transformers and switchboards have been received lately in large volume by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa. The purchasers of such apparatus mentioned in that company's latest report are the Centralia (Ill.) Gas & Electric Company, the city of Cleveland, Ohio; the Maryland Electric Railway Company, of Annapolis, Md.; the Hartford (Conn.) Electric Light Company, and Sears, Roebuck & Company, of Chicago, Ill.

Electrical Domestic Appliances Have Italian Market.—The Bureau of Foreign and Domestic Commerce at Washington, D. C., has received from Vice-Consul Leon Böhm de Sauvanne, of Leghorn, Italy, a list of the electric-lighting companies, the voltages in use in the different cities and the principal wholesalers and dealers in heating and cooking appliances in that consular district. This list was accompanied by the statement that such appliances are regarded there as luxuries, but that their sale is increasing and that most of the dealers make their purchases from the important commercial centers, principally from Milan.

Transmission-Line Specialty Sales.—The Clark Electric & Manufacturing Company, of 149 Broadway, New York, has received through the Electric Bond & Share Company, of New York, an order for suspension choke coils, contact grounding devices and other power-house equipment for the Utah Power & Light Company, and another order for suspension-type line disconnecting switches for the Carolina Power & Light Company. The Clark protective clamping set, for use at railroad right-of-way or where lighting circuits cross over or under telephone lines, has recently been approved by the Chicago Telephone Company. Several of these sets have been ordered for shipment to Japan.

Equipment of R. A. Waller Substation, Chicago.—The board of trustees of the Sanitary District of Chicago has awarded the contract for alterations and additions, including the furnishing of electrical equipment, in the R. A. Waller substation, Chicago, to the W. A. Jackson Company for $27,850. This is one of the city substations for electric street lighting and is operated by the Sanitary District. The contractor agrees to furnish oil switches, potential transformers, ammeters, voltmeters, a 100-amp-hr. storage battery and a 3-kw motor-generator to charge it. All of this apparatus will be of General Electric make except the battery, which will be obtained from the Electric Storage Battery Company. The District will furnish six 250-kva step-down transformers and the constant-current arc regulators. During the rehabilitation the station will be kept in service.

Kansas City Manufacturer Has Optimistic Outlook.—Weather conditions in some parts of Kansas recently have left a good deal to be desired, and it is therefore refreshing to note the optimistic strain in the following letter received from the Barber-Dwinnell Company, Kansas City, manufacturer of storage-battery lighting plants, electrical machinery and supplies: "In spite of the adverse crop conditions in our territory, we are able to say that our business so far this year has shown a healthy increase over that of last year. In Century fans the business is almost double that of last season."

Spain to Have a National Commercial Museum.—According to recent reports from Consul F. T. F. Dumont at Madrid, Spain, steps are being taken toward the establishment of a national commercial museum of large size and scope for that country. The service will be divided into five administrative bureaus, as follows: Permanent exhibition of samples, internal commerce and transportation, external commerce and transportation, contract laws in Spain and foreign countries, publications and references. The whole movement is designed as a sort of adjunct to the Spanish consular service, a headquarters for trade information.

Fixture Salesmen Convene.—Celebrating the removal of the factory and the general sales office to their new quarters at Cleveland, the United States and Canadian sales forces of the Tungstolier Works of the General Electric Company held their annual conference at Cleveland, Ohio, during the week ended Aug. 16. Eighteen salesmen and branch managers met to visit the new plant just opened and to discuss plans for a very active sales campaign to be conducted during the coming year. Glenn C. Webster, general manager of the works, F. C. Maxheimer, sales mananger, and W. H. Fisher, superintendent of the factory, predicted the biggest fixture year in history.

Telephones to Be Sold in Standard Packages.—Following in the footsteps of the famous "Inner Seal," the Western Electric Company has decided to introduce a novelty into its selling system by putting out its two-station, interphone sets in standard packages. There will be two styles of these packages, according to present plans, one for the familiar wooden-wall type of intercommunicating telephones, and the other for the more convenient hand set, having transmitter, receiver and ringing button all on one handle. Two kinds of wiring outfits will be supplied in these standard packages, one for interior and the other for exterior connecting lines.

Cheap Electrical Evaporation Process Claimed.—The firm of Halbert P. Hill, Inc., of 30 Church Street, New York, is taking over the exclusive manufacturing, sales and licensing rights on the General Reduction Company's process of taking solids from containing liquids. The process is said to be a mechanical and electrical one and is claimed to make it possible to reduce skimmed milk to a powder at a cost of less than $1 per ton of liquid. It is stated to be adaptable to the making of solid glue, recovering of packing house by-products, production of sugar direct from the cane juice, and the manufacture of various other chemical and industrial products. The apparatus is built in several sizes, the smaller ones being operated wholly by electricity. The above-mentioned agents are ready to send printed

matter describing the apparatus and to demonstrate the same at their laboratories to central stations or other interested parties.

New Equipment for Jamestown (N. Y.) Municipal Plant.—Supplementing a note in the July 19 issue of the *Electrical World* it is learned that at a recent taxpayers' election in the city of Jamestown, N. Y., the proposition to bond the city for $40,000 to provide for improvements and extensions to the municipal electric-lighting plant was approved by a vote of 430 to 184. On Aug. 15 the board of municipal electric lighting commissioners held a special meeting to consider bids for two seventy-five-light street-lighting sets. The commissioners awarded the contract for one set to the Westinghouse Electric & Manufacturing Company for $3,214.56. This amount was lower than the bid of the General Electric Company, which was the only other concern making a tender.

New Jersey Motor Manufacturer Enlarges Plant.—Additions are being made to the plant of the Bell Electric Motor Company, of Garwood, N. J. The new buildings are well under way and will be completed shortly, when the company will be able to double its output. It has recently received many orders for motor-generator sets, for storage-battery charging and similar service, and at present this is becoming a large part of its business. An order has just been placed by the Central Railroad of New Jersey for this class of apparatus, to be used for charging batteries on the baggage trucks in its new passenger station at Jersey City. Nine motor-generator sets, each consisting of a 40-cycle, single-phase motor directly connected to a direct-current generator, were shipped a short time ago to the Postal Telegraph Company at Albany, N. Y.

Scientific Management in Hotel Lighting.—An unnecessary expense, which in the aggregate is heavy, is incurred in an electrically illuminated hotel every time that a guest leaves his room and forgets to turn out the lights. At the same time it gives an air of "smallness" to the house to install any form of switch that will automatically extinguish the lights, unless at the same time it is arranged to turn them on again automatically at the guest's return. Working to this end, the Hart Manufacturing Company, of Hartford, Conn., maker of the Diamond H line of switches, perfected not long ago a door-bolt solenoid switch that is arranged to accomplish both desired results. The company has had large success in introducing this switch into big hotels in Chicago and other Western cities, although the Eastern hotels are a little backward in adopting it.

Robbins & Myers Welfare Work.—Following a very busy season in its factory at Springfield, Ohio, the Robbins & Myers Company instituted a big "get-together" day for its factory and office force during the second week of August. The occasion was one in which the entire corps of employees, from the officers and owners to the least important workers, participated, and it afforded each class an opportunity to benefit by getting better acquainted with the aims and personalities of the other. The question of whether an individual is at the head or at the tail end of a business is not only one of latent mentality but also, in most cases, of early opportunity and environment. This company seems to be aiming at closer co-operation between the various parts of its organization by bringing them together in other relations besides those of master and servant.

Troubleman's Searchlamp Popular.—The portable troubleman's searchlamp, manufactured by the Electric City Sales Company, of Marion, Ind., is finding wide distribution among the central stations of the country which have transmission lines to maintain. The following companies have recently added this type of lineman's lamp to their equipment: Pacific Light & Power Company, Manchester Traction, Light & Power Company, Edison Electric Illuminating Company of Brooklyn, Butte Electric & Power Company, Evansville Public Service Company, Sao Paulo Tramway, Light & Power Company and Central Hudson Gas & Electric Company, and in addition lamps have been sold to the cities of Galveston, Tex., and Winnipeg, Canada. The lamp gas container and accompanying apparatus were described and illustrated in the *Electrical World* of May 18, 1912.

Advocating Interstate Trackless Trolley Line.—There is some agitation on foot in favor of the installation of a trackless trolley service from West Pawlet, Vt., to West Granville, N. Y., passing through the towns of Wells, Vt., and Granville, Middle Granville and North Granville, N. Y. The length of the proposed line would be about 15 miles and a present population of about 7000 would be affected. Thomas F. Healey, of Middle Granville, is interested in the project and, if it is finally installed, the system may draw its electrical energy supply for operation from the Western Vermont Power & Light Company, of Fairhaven, Vt. A franchise has been granted for the construction of a regular trolley line over part or all of the above route, and it is thought that this will cover the proposed trackless trolley installation. The advantages of the latter are a reduction in the cost of construction, because of the elimination of all grading work and laying of tracks, and also a greater flexibility of operation than is afforded by the ordinary trolley system. The coach proposed for this line is of the semi-convertible, one-man, prepayment type, equipped front and rear with dual rubber tires, and having an individual motor drive on each wheel. This four-motor, four-wheel drive, combined with rubber tires, gives maximum traction and, with a reasonably hard road surface, makes the vehicle adaptable for use under all conditions of weather.

German Electrical Exports Show an Increase During 1912.—In the following table is shown a comparison between the figures for the first six months of 1912 and those for the same period this year on German electrical exports. It is worthy of note that out of the seventeen items covered, embracing all the important classifications, decreases occurred in only four. Of interest also is the fact that during the first half of this year the imports of electrical goods amounted to about $1,527,000, while for the same time last year these imports were valued at approximately $1,235,000.

GERMAN ELECTRICAL EXPORTS

Classification	Value, January to June Inclusive	
	1913	1912
Dynamos, motors, transformers, etc.	$6,430,000	$5,575,000
Armatures and commutators	920,000	720,000
Secondary batteries and electrodes	596,500	756,000
Cables	4,435,000	2,735,000
Arc lamps, mercury-vapor lamps, etc.	341,500	316,500
Searchlamps, etc.	282,300	112,700
Metal-filament lamps	4,765,000	5,415,000
Carbon-filament lamps	463,000	390,000
Telegraph apparatus	133,700	173,500
Telephone apparatus	881,000	623,000
Safety and signaling apparatus	452,000	447,000
Wireless telegraph and telephone apparatus	170,000	179,700
Apparatus for lighting, power transmission, etc.	6,140,000	4,230,000
Medical apparatus	481,000	476,500
Measuring apparatus	2,697,000	1,964,000
Primary batteries	282,000	184,700
Insulating tubes	350,000	291,500

Hartford Telephone Manufacturer Installs Motor Drive.—The new plant of the Gray Pay Telephone Company at Hartford, Conn., has recently been completed. Ten small two-phase 220-volt Western Electric induction motors, with a total capacity of 115 hp, have been installed, together with seven ovens of 50-kw capacity each and a 10-kw welding machine. The ovens are used for baking enamel on the telephone cases and are controlled through circuit-breakers operated by time switches mounted on a separate switchboard. There are 650 lighting outlets, those on benches and machines being provided with White adjustable fixtures, and those for general lighting being supplied with Benjamin single-light fixtures. A power panel on each floor controls the motors and the feed wires run from these panelboards to a four-panel switchboard. All feeders both for power and lighting are in conduits and all branch lines are placed in National Meta molding. Trumbull panelboards and switchboards are used throughout, and the contracting work was done by the L. K. Comstock Company, of 30 Church Street, New York. G. W. Perry, wire inspector of the Hartford Board of Fire Commissioners, from whom the above item is received, states in addition that prospects are bright for a good growth of business during the coming autumn. Several large buildings are now under construction, among them the new office building of the Hartford Electric Light Company.

Bids Sought for Alternating-Current Synchronous Condensing Apparatus.—The clerk of the Sanitary District of Chicago will receive sealed proposals for furnishing alternating-current synchronous condensing apparatus and also for furnishing round manhole frames and covers, at the office of the District, 900 South Michigan Avenue, Chicago, until noon on Aug. 28. Specifications, plans and form of proposal may be obtained upon application at the office of the Sanitary District, of which John McGillen is clerk.

Brookfield Insulators Used in a Difficult Climate.—Following difficulty in obtaining an adequate insulator for low-tension service in the salt swamp district of Utah, the Brookfield Glass Company, of 2 Rector Street, New York, has perfected a new type of insulator which has been adopted by the Postal Telegraph-Cable Company for the lines which it operates in this locality. It was found that with the earlier type of insulator the salt dust would settle on the surface of the glass, and when a slight rain or snowfall came the salt solution formed would serve to short-circuit the line. The new type of insulator is improved by having a large and comparatively flat exposed surface which can be cleaned conveniently, two large protected inner areas and, finally, a deep inner petticoat which makes the leakage path extremely long. While this type of insulation was developed primarily for the peculiar conditions above mentioned, it is suitable for use on any low-voltage line.

Tungstolier Works Move to Cleveland.—The Tungstolier Works of the General Electric Company, formerly located at Conneaut, Ohio, are now located at Cleveland, Ohio, the factory and office having been transferred on Aug. 1. The plant now occupied by the fixture works is known as the Ivanhoe Metal Works of the General Electric Company and is situated on Ivanhoe Road in East Cleveland. This new plant is a magnificent structure of brick and stone, equipped with the most modern apparatus for producing formed and cast-metal products. Speed machines, spinners, presses and automatic devices of many kinds have been installed. The conveniences provided for employees include a cafeteria, a library, rest and recreation rooms and shower baths. Under the direction of Glenn C. Webster, general manager of the Tungstolier Works, the plant has been organized and systematized to operate at highest efficiency. From the designing room to the shipping room the effort of the organization is to turn out the products in the best possible manner and in the quickest possible time. The headquarters of the Tungstolier sales organization are located in the downtown district, at Euclid Avenue and Nineteenth Street. Showrooms have been equipped at this address and everything which leads to complete and comprehensive service to the trade has been installed.

Steel Works Drew Energy Supply from Large Central-Station System.—Several of the independent steel companies in the coal and iron region of Pennsylvania and West Virginia, among them the Apollo (Pa.) Steel Company, Weirton (W. Va.) Steel Company, West Leechburg (Pa.) Steel Company, Blaw Steel Construction Company, of Hoboken, Pa., and the Vanadium Alloys Company, of Pittsburgh, Pa., are large users of electric drive and draw their energy supply from the lines of the West Penn Traction Company. In the cold-rolling department of the West Leechburg company's plant electricity is extensively used for driving the rolls, machine tools, cranes and lifting magnets. The energy is brought in on lines from the Connellsville (Pa.) generating station, although there is connection to the lines of the Allegheny Valley station for use in emergency. This three-phase, 60-cycle current, at 2200 volts pressure, is converted to direct current by means of a synchronous motor-generator set, as the service demands a wider range of speed variation than can easily be obtained with the present standard alternating-current apparatus. The Weirton company has just completed the construction of a group of mill buildings (the largest of which occupies a ground area measuring 300 ft. by 200 ft.), in which all rolling-mill drive and auxiliary mechanical operations will be done electrically. Energy for this electrification is to be drawn from the substation at McDonald, Pa., the tension on the incoming wires being 25,000 volts. Here again the direct-current drive is preferred, and for the same reason as in the case of the above-mentioned plant, and, in order to obtain this from the alternating-current supply, two motor-generator sets of 1500-hp rating have been installed by the steel company.

Electrical Properties Company Readjustment.—Stockholders of the Electrical Properties Company have approved the plan for reduction and readjustment of its capital stock, proposed by J. F. Wallace, H. R. Hayes and A. M. Chambers. The concern's assets will be sold to a new company to be known as the Electrical Properties Corporation, which will own all the capital stock of Westinghouse, Church, Kerr & Company.

Public Service Company of Northern Illinois.—The Chicago newspapers publish a rumor to the effect that the dividend rate on the common stock of the Public Service Company of Northern Illinois is to be increased from 4 per cent to 5 per cent before the end of the year. This company, which is one of the Insull properties, has an aggregate funded debt, including that of the underlying properties, of $26,699,100, besides $2,500,000 in three-year 6 per cent notes. It has issued $7,588,000 in 6 per cent preferred stock and $9,062,000 in common stock. It serves a large and prosperous area surrounding Chicago in northeastern Illinois.

Sale of Toronto Hydro-Electric Bonds.—General debentures of the Toronto Hydro-Electric Commission, amounting to $4,220,000, were disposed of to N. W. Harris & Company, of New York and Chicago, the bonds, which bear interest at 4 per cent, being at 83, making the effective interest about 5 per cent. This is the first sale of the commission's bonds, which have heretofore been refused by the London market, the reason commonly given being that Toronto interests have carried on an active campaign in London to discourage the purchase of public utility securities. The importance of this sale to the city will be understood when it is stated that through inability to dispose of them before the city has held these bonds in its own sinking fund, utilizing the money they represent for construction work on the municipal electric system.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Aug. 20	Aug. 26
Allis-Chalmers, t.r., 5th pd	$19,800,000	.....	.....	9¾	7½*
Allis-Chal., pf., t.r., 5th pd	16,050,000	.....	.....	20	19*
Amalgamated Copper	153,887,900	1½	Q	74	73½
American Tel. & Tel.	344,471,400	2	Q	130½	130½
Electric Storage Battery,c	16,074,425	1	Q	47¾	48
General Electric	101,363,600	2	Q	145½	145
Mackay Cos., c.	41,380,400	1½	Q	86	86*
Mackay Cos., pf.	50,000,000	1	Q	67	67*
Western Union Tel.	99,747,600	¾	Q	67½	68*
Westinghouse, E. & M., c.	34,496,400	1	Q	72	71⅞
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	119½	119*

*Last price quoted.

NEW YORK METAL MARKET PRICES

	Aug. 18 Bid.	Aug. 18 Asked.	Aug. 25 Bid.	Aug. 25 Asked.
Copper:				
Standard, spot*	....	.....	.....	16.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	69 15 0		69 10 0	
Prime Lake	....	16.00	15.85	to 15.95
Electrolytic	15.85	to 15.95	15.70	to 15.80
Casting	15.70	to 15.80	15.60	to 15.70
Copper wire base	16.75	to 17.00	16.75	to 17.00
Lead		4.75		4.75
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter		7.75		7.75
Spelter, spot	....	5.87½	.....	5.87½
Tin, spot*	41.40	to 41.65	41.15	to 41.50
Aluminum:				
Prompt delivery	22.50	to 23.00	22.25	to 22.75
Future	20.00	to 21.00	20.00	to 21.00

*OLD METALS

Heavy copper and wire	14.50	14.50
Brass, heavy	9.25	9.25
Brass, light	8.25	8.25
Lead, heavy	4.40	4.65
Zinc, scrap	4.62½	4.62½

*COPPER EXPORTS

Total tons to Aug. 25 27,597

*From daily transactions on the New York Metal Exchange.

Business Notes

The Wagner Electric Manufacturing Company, of St. Louis, has opened a store and service department for the maintenance of its automobile starters at 1253 Woodward Avenue, Detroit, and is combining this with its Detroit office, which has heretofore been in the Ford Building.

Frederick Rall, of 19 Park Place, New York, has just completed arrangements with the Trumbull Vanderpoel Electric Manufacturing Company, of Bantam, Conn., for handling that company's line of knife switches, panelboards and switchboards and electrical specialties in Greater New York and vicinity.

The Hurley Machine Company, of Chicago, Ill., has been forced to add extensively to its sales force in order to keep pace with the growth of its business in Thor electric washing machines. J. M. Hurley, vice-president and director, has recently taken charge of the company's Eastern territory, with headquarters in the Flatiron Building, New York.

M. W. Dunton Company.—Mr. R. L. Thayer, of 424 South Clinton Street, Chicago, has been appointed Illinois sales manager for the M. W. Dunton Company, of Providence, R. I., which manufactures "Nokorode" soldering paste. This paste is compounded for the electrical trade and is said to be absolutely non-corrosive.

The Blaw Steel Construction Company recently completed a new office building of its own at Hoboken, Pa., and moved its general offices to that structure. It also established a short time ago a branch sales office at 621 Farmers' Bank Building, Pittsburgh, Pa. The company has secured the services of L. W. Barnette, for many years secretary and sales manager of the Franklin Steel Company, of Franklin, Pa. He will have his headquarters at 165 Broadway, New York, and will handle the sales of transmission towers and steel poles and the general structural steel business of the company in the East.

New Industrial Companies

The Electric Traffic Signal Company, of Seattle, Wash., has been incorporated with a capital stock of $35,000 by B. A. Hendricks, F. E. Parker and others.

The Indianapolis House-Lighting Company, of Indianapolis, Ind., has been incorporated by Carl L. Rost, O. V. Eaton and C. C. Horner. The company is capitalized at $50,000 and proposes to install individual lighting plants.

The California Mechanical & Electrical Engineering Company, of Sacramento, Cal., has been incorporated with a capital stock of $10,000 to carry on a mechanical and electrical engineering business. The incorporators are: J. F. Woods, R. J. Finchley and H. J. Schmeling.

The Tyre Service, Inc., of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000. The incorporators are: Charles L. Chine, M. M. Hovey and John C. Travis, 2 Rector Street, New York, N. Y. The company purposes to manufacture motor engines, machines, etc.

The Maxwell Nut-Lock Manufacturing Company, of Jersey City, N. J., has been incorporated with a capital stock of $150,000 for the purpose of doing a mechanical and electrical engineering business. The incorporators are: J. Silvestro, W. B. Maxwell, J. Klein, Jr., C. B. Knudsen, of New York, N. Y., and W. Lewis, of Jersey City, N. J.

Trade Publications

Lamp Sockets.—A leaflet has been issued by the H. W. Johns-Manville Company, New York, in which J-M molded weatherproof lamp sockets are illustrated and briefly described and a price list is given. A few other J-M products are alphabetically listed.

Rotary Converters.—Commutating-pole rotary converters are described in detail in Leaflet No. 3571 of the Westinghouse Electric & Manufacturing Company. The leaflet is illustrated, the constructive details are given at some length, and views of applications of this apparatus are shown.

Bushings.—A sample of the No. A1 bushing, between the two parts of which is fastened a fac-simile of the No. 3 Federal outlet box cover, is being distributed by the Federal Sign System (Electric), Chicago. These bushings are quickly inserted and easily removed, as shown by several miniature illustrations.

Power Plant Supplies.—The Schutte & Koerting Company, Philadelphia, has issued a twenty-two-page catalog, in which its power-house equipment is illustrated and described. Injectors, condensers, valves for various purposes, chimney ventilators, furnace blowers and other devices are referred to.

Generators.—In Leaflet No. 3685 of the Westinghouse Electric & Manufacturing Company type SK direct-current commutating-pole generators from 1½ kw to 200 kw, 125-250 volts, are described and illustrated. These generators have rolled-steel frames, commutating poles, low operating temperature and large overload capacity.

Laundry Machinery.—The Hurley Machine Company, Chicago, has recently distributed a folder in which are four cartoons showing how the substitution of a Thor electric washing machine for the old washboard drudgery solved the laundry problem in one home and brought added happiness to the household, as well as increased freedom for the woman.

Storage-Battery Lighting Plants.—In an eight-page pamphlet bearing the imprint of the Barber-Dwinnell Company, 600 East Fifteenth Street, Kansas City, Mo., storage-battery electric-lighting plants for towns and country residences, public buildings, business houses and small cities are fully described. Some interesting practical information on the subject is given.

Conduit.—M. B. Austin & Company, Chicago, are sending out revised sheets, designated as Austin No. 33 and Austin No. 34, on "Galvaduct" and "S. A. C. Co. Special" conduit, and another sheet referring to "loricated" conduit and containing revised prices on rigid conduits, the latter known as Austin No. 35 and Austin No. 36. These leaflets take the places of others on the same subjects issued in June.

Railroad Electrification.—In Leaflets Nos. 3572 and 3660, issued by the Westinghouse Electric & Manufacturing Company, are covered the salient points of the electrification of the New York extension of the Pennsylvania Railroad and the New York, New Haven & Hartford Railroad. A description is given of the more important parts of the equipment. The leaflets are fully illustrated and contain maps showing the territories covered by both of the electrified systems.

Motors.—Bulletin A recently issued by the United States Electrical Manufacturing Company, Los Angeles, Cal., has for its subject type "FR" constant-speed riveted-frame-construction polyphase induction motors, ¼-hp to 15-hp, two-phase and three-phase, with indestructible squirrel-cage rotors, 50 and 60 cycles, 110, 220 and 440 volts. A supplementary bulletin contains two full-page diagrams, the one showing the general construction and the other showing the ventilation and construction of these motors.

Electric Welding.—The industrial and power department of the Westinghouse Electric & Manufacturing Company has issued in pamphlet form a reprint of an article on "Electric-Arc Welding Processes" recently published in the technical press by Mr. C. B. Auel, director of processes, standards and materials of the Westinghouse Company. The paper, which is well illustrated, explains in an interesting manner the different processes employed in arc welding, their advantages and limitations, and gives some figures of comparison of arc and blacksmith welding.

Transformers.—Bulletin No. 570 of the American Transformer Company, Newark, N. J., refers to the high-voltage testing transformers and complete testing sets. In order to determine accurately the insulating values of materials which must possess high dielectric strength, the company has developed equipments incorporating in one unit all the features which would serve to make their use convenient and flexible. Two standard equipments have been devised, type "TS-1" for 50,000 volts and type "TS-2" for 5000 volts. This new apparatus is fully described and illustrated.

Personal Mention

Mr. J. H. Lawton, formerly of Oskaloosa, Ia., has become manager of the New Sharon (Ia.) station controlled by the same interests.

Mr. C. A. Dow has been appointed superintendent of the Alliance (Neb.) Water and Light Department as successor to Mr. W. C. Barnes.

Mr. L. W. Crehore has been appointed city engineer and superintendent of electricity, water, streets and sewers of the city of Fallon, Nev.

Mr. H. M. Ferguson has been appointed manager of the commercial department of the Missoula (Mont.) Light & Water Company as successor to Mr. J. F. Derge.

Mr. Oliver B. Miller has been appointed manager of the municipal electric light plant at Genoa, Neb., as successor to Mr. O. A. Clark, who resigns on Sept. 1.

Mr. W. B. Powell has been elected general manager, secretary and treasurer of the Villa Rica (Ga.) Electric Light & Power Company in place of Mr. G. B. Malone.

Mr. B. F. Tucker has become district superintendent of the Taylorville (Ill.) district of the Central Illinois Public Service Company. Mr. Tucker was formerly at Virden, Ill.

Mr. I. R. Ellison, of Chicago, has been engaged as superintendent of the municipal electric light plant at Eaton Rapids, Mich., as successor to the late W. H. Woodmansee.

Mr. J. A. Porter, formerly manager of the Paris (Tex.) Light & Power Company, has been made assistant to the president of the Light & Development Company of St. Louis, Mo.

Mr. F. D. Mahoney, formerly with the Luzerne County Gas & Electric Company at Kingston, Pa., has become associated with the Kewanee (Ill.) Light & Power Company as construction engineer.

Mr. Henry Floy has been appointed an appraiser of the assets of the John F. Stevens Construction Company of New York, which has contracts for certain sections of New York's new subways. The company was recently placed in the hands of a receiver.

Mr. R. C. Jones, secretary and treasurer of the San Antonio (Tex.) Gas & Electric Company, has been elected secretary of the San Antonio Traction Company, of which he is treasurer and assistant general manager. Mr. Jones succeeds Mr. O. O. Woodman as secretary.

Prof. H. H. Higbie has resigned as head of the electrical department of the Wentworth Institute, Boston, to become professor of electrical engineering at the University of Michigan, Ann Arbor, Mich., with which he was connected prior to his work at the Wentworth Institute.

Mr. C. E. White, manager of the Montgomery (Ala.) Light & Water Power Company, who is a past-president of the Southern Gas Association, has been appointed the delegate of the association to represent it at the International Gas Congress, to be held in San Francisco in October, 1915.

Mr. George H. Lawrence, of North Adams, Mass., has resigned his position as a member of the newly elected Public Service Commission of Massachusetts owing to pressure of other work. Mr. Lawrence was considered by many as the member with the widest experience, and perhaps the ablest, of the new board appointed by Governor Foss on June 25.

Mr. G. W. Borst has been appointed chief electrical engineer of the Chicago Fuse Manufacturing Company, succeeding Mr. C. T. McDonald. For three years prior to July 1 Mr. Borst was connected with the engineering department of the Western Electric Company in Chicago. Before that he was associated with the Westinghouse Electric & Manufacturing Company in Pittsburgh.

Mr. Carl O. Y. Montelius, assistant chief engineer, and Mr. Hugo M. Rahmberg, electrical engineer, electrification department Swedish State Railways, Stockholm, arrived in New York Aug. 25 to spend ten weeks in America inspecting high-tension transmission systems and installations of heavy electric traction. After visiting plants in the East and in the vicinity of New York, Messrs. Montelius and Rahmberg plan to travel westward, stopping at Niagara Falls, Bay City, Chicago, Keokuk, Denver, Butte, Los Angeles and San Francisco, sailing from the last-named city for the return trip via the Orient.

Mr. Arthur L. Robinson has resigned as superintendent of the mechanical division of the Isthmian Canal Commission and has returned to the United States from the Canal Zone. He served as electrical engineer in connection with the electrical and mechanical work on the Panama Canal from 1905 until 1909. In the latter year he was appointed head of the mechanical division. In this position he made improvements in the arrangement of the shops, one of his changes resulting in an annual saving of $105,000 in overhead expense. Before going to the Isthmus Mr. Robinson, whose home is in Louisville, was head of the electrical department of the Southern Railway.

Mr. George H. Duffield, for many years special representative of the National Electrical Contractors' Association of the United States, has been appointed secretary of that body as successor to Mr. W. H. Morton, whose resignation was recently announced in these columns. Mr. Duffield was born in Clayton, N. J., Nov. 30, 1882. He was graduated from the Bridgeton (N. J.) High School and the Drexel Institute. Immediately after his graduation Mr. Duffield was employed by the Public Service Corporation at Camden, N. J., and later accepted a position with Messrs. J. G. White & Company as construction electrical engineer. Receiving an appointment with the engineering department in the national government, Mr. Duffield severed his connection with J. G. White & Company to assume charge of the installation of the electrical controlling apparatus of the Mississippi River lock at Rock Island Arsenal. While in the employ of the government Mr. Duffield also had charge of the construction of a 90-mile telephone system and made river surveys and chemical analyses. He left the government employ to become associated with Mr. J. T. Marron, electrical contractor and manufacturer of Rock Island, and was placed in charge of the manufacturing end of the business conducted by the Tyro Electrical Manufacturing Company. Mr. Duffield later resigned to accept the position of special representative of the National Electrical Contractors' Association, which he has filled with credit for the past three and one-half years. During that time Mr. Duffield visited every state in the Union twice in the interests of the National Electrical Contractors' Association, collected electrical data, organized state and local associations, increased the membership in the national body and promoted the interest of the *National Electrical Contractor*. Having personal acquaintance with almost every responsible electrical contractor in the United States and being intimately versed in the details of editorial and managerial work in connection with the official organ of the association, Mr. Duffield is eminently fitted for the post to which he has just been appointed.

GEORGE H. DUFFIELD

Obituary

Mr. James Stevenson, of the Crowley & Stevenson Electric Company, electrical dealer and contractor of Duluth, Minn., met his death on Aug. 19 as the result of a distressing accident. While directing repair work on an electric crane in a boiler factory he was caught between the moving crane and the steel girders of the shop and so badly crushed that he died three hours later. Mr. Stevenson was forty-four years old and leaves a widow and two children. For seven years before March 1 he had been connected with the Northern Electrical Company of Duluth. The body was taken to Martinsville, Ind., for burial.

Construction

New England

SKOWHEGAN, ME.—The Somerset Trac. Co., of Skowhegan, will award a contract for the construction of a substation within the next 30 days.

CHELMSFORD, MASS.—The Lowell El. Lt. Corpn., of Lowell, has submitted a proposition to the Water Commissioners for furnishing energy at the pumping station.

MALDEN, MASS.—The Street and Water Commission is considering plans for the installation of an ornamental street-lighting system on the business streets of Central Square and has asked the City Council for an appropriation of $42,000 for street-lighting next year, which will provide for ornamental lamps.

NEW BEDFORD, MASS.—The stockholders of the New Bedford Gas & Edison Lt. Co. have voted to increase the capital stock by 2650 shares to be sold at $200 per share. The proceeds will be used for extensions and improvements in the power plant and for extensions to business.

READING, MASS.—Preparations are being made by the Reading municipal electric light board for improvements and extensions to the municipal electric plant, involving an expenditure of about $25,000.

TAUNTON, MASS.—Mayor Fish has signed the order appropriating $50,000 for a new generating unit for the municipal electric-light plant.

NARRAGANSETT PIER, R. I.—The Narragansett Pier El. Lt. & Pwr. Co. has recently completed a 6-mile extension to its system to Matunuc Beach. R. I. W. C. Clarke is general manager.

PASCOAG, R. I.—The Pascoag Fire District has decided to continue to operate its municipal electric-light plant, instead of purchasing electricity from the Blackstone Valley Gas & El. Co. to operate the system. Improvements will be made to the plant, to cost about $4,000.

Middle Atlantic

AURORA, N. Y.—The Aurora El. Lt. Co. expects to purchase within the next six months about 1000 incandescent lamps. N. L. Zabriska is manager.

LONG ISLAND CITY, N. Y.—Contracts have been closed between the New York & Queens El. Lt. & Pwr. Co., of Long Island City, and the General Vehicle Co., of New York, whereby the former will furnish energy to operate the manufacturing plant of the latter, now being erected on Borden Avenue, Long Island City. The New York & Queens El. Lt. & Pwr. Co. has also signed a contract to furnish energy to operate the factory of Joseph Haberman & Co., on Borden Avenue.

MARION, N. Y.—The Marion Pwr. Co. has just completed the erection of a distribution line, including transformers, costing about $6,000 for the Wayne Cold Storage Co., of Marion. The line from Williamson to Marion has recently been rebuilt.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Sept. 2, for additions and repairs to the electric equipment at De Witt Clinton High School, High School of Commerce and Wadleigh High School, borough of Manhattan; for additions to and alterations in the electric equipment of Public School 18, Broadway, West New Brighton, borough of Richmond. Also for fire protection work at Public School 3, Church Street, Pleasant Plains; Public School 4, Shore Road, Kreischerville, and Public School 29, Manor Road, West New Brighton, borough of Richmond. Blank forms, plans and specifications may be obtained at the office of the superintendent of school buildings, corner of Park Avenue and Fifty-ninth Street, borough of Manhattan.

PHOENIX, N. Y.—The Seneca River Pwr. Co., of Phoenix, is changing the present arc-lamp street-lighting system to 250-watt tungsten lamps. E. M. White, of Phoenix, is vice-president.

RANDOLPH, N. Y.—The Randolph El. Lt. & Pwr. Co. expects to purchase within the next six months one 100-kw to 150-kw, three-phase, 60-cycle, 2300-volt generator and engine suitable for same. J. W. Grace is manager.

ALBURTIS, PA.—Preparations are being made for the installation of an electric-lighting system in Alburtis.

ALLENTOWN, PA.—The Lehigh Valley Transit Co., of Allentown, has closed a contract whereby it will supply electricity to the Philadelphia Suburban Gas & El. Co., which furnishes electrical service in North Wales, Lansdale and suburban districts.

EPHRATA, PA.—The Borough Council has accepted the bid of the Westinghouse El. & Mfg. Co., of Pittsburgh, for furnishing the new 350-kw turbo-generator set, exciter and switchboard and condenser for the municipal electric-light plant, at $11,600.

LANSFORD, PA.—The Lehigh Coal & Navigation Co., of Lansford, expects to purchase within the next two months an electric shaft hoist (700-hp), including transformers and instruments, circuit-breaker, etc. Albert Leonarz is superintendent.

MEDIA, PA.—The municipal light committee expects to purchase in the near future engine, generator and pumps of 1,000,000-gal. capacity. The Council as yet has taken no definite action on this matter. The committee also expects to purchase within the next two months some 30-ft. and 35-ft. poles. P. E. Ahearn is superintendent.

PATTON, PA.—The Penn Central Lt. & Pwr. Co., of Altoona, has taken over the plant and holdings of the George S. Good El. Co., of Patton. It is understood that improvements will be made to the electric service.

PITTSBURGH, PA.—The Pittsburgh, Harmony, Butler & New Castle Ry. Co., it is reported, has secured an option on the organ works in Morado, where it proposes to build a new power plant.

JERSEY CITY, N. J.—Plans are being considered for the installation of a new street-lighting system on Newark Avenue. The service will be furnished by the Public Service El. Co.

WOODSTOWN, N. J.—The Woodstown Ice & Cold Storage Co. expects to erect within the next six months 3 miles of distribution lines. C. F. Moore is manager and treasurer.

CRISFIELD, MD.—The Crisfield Lt. & Pwr. Co. has applied to the Public Service Commission for permission to issue $10,000 in additional capital stock, the proceeds to be used for improvements.

LONACONING, MD.—The Home El. Lt. Co., of Lonaconing, has purchased the controlling interest in the Lonaconing El. Lt. & Pwr. Co.

MANASSAS, VA.—Bonds to the amount of $75,000 have been voted for the installation of a municipal electric light plant, water-works and sewer systems. Harry Stevens, Union Trust Building, Washington, D. C., is engineer.

ROANOKE, VA.—The Norfolk & Western Ry. Co. has awarded the contract for electrical equipment for its Bluefield-Vivian section (85 miles in length) to the Westinghouse El. & Mfg. Co., of Pittsburgh. The contract calls for all electrical equipment required, including 26 120-ton electric locomotives of the single-phase and two-phase type, with all power house generating machinery and transmission apparatus. Energy for operating the entire section will be generated by a central power plant located at Bluestone, W. Va., having an output of 27,000 kw.

ROCKY MOUNT, VA.—The capital stock of the Lt. & Pwr. Co., of Rocky Mount, has been increased from $5,000 to $15,000, the proceeds to be used to purchase the water rights at Pelter's Ford on Pigg River, about 2 miles from the town, and the construction of a concrete and wooden dam. About 200 hp will be developed, enabling the company to furnish a continous service for lamps and motors.

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, Washington, D. C., until Sept. 8, for furnishing four motor-driven vertical centrifugal pumping sets. Further information may be secured upon application to above office.

WASHINGTON, D. C.—A report from an American consul states that the Director of General Telegraphs and Telephones in a Latin-American country is contemplating the purchase of telephone supplies. For further information address No. 11,534, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Supplementing a previous report, an American consular officer advises that an award which was made recently for two electrically operated cranes for local dry dock has been annulled and new proposals will be received. A diagram, with blueprints, showing dimensions of the two cranes, accompanied by report, may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., referring to No. 11,535.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 16 for furnishing at the various navy yards supplies as follows: Brooklyn, N. Y., Schedule 5802—1000 ft. lead-covered, paper-insulated single conductor, Washington, D. C., Schedule 5804—two 3-ton electrically operated hoists. Eastern yards, schedule 5795—miscellaneous lamp sockets. Bids will also be received at the same place until Sept. 23 as follows: Washington, D. C., Schedule 5812—for furnishing and installing seven soot cleaners on boilers. Applications for proposal should designate the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

North Central

GRAND RAPIDS, MICH.—The Roseberry-Henry Co., of Grand Rapids, has secured the contract for installing an electric-light system at the West Michigan State Fair Grounds. The contract provides for 1000 lamps, of which 500 will be erected throughout the grounds and the remainder in the buildings.

GRAND RAPIDS, MICH.—The Stowe-Davis Furniture Co. has awarded a contract to the Wernette-Bradford-Meade Co., electrical contractor, for remodeling its power plant, to cost about $5,000. The plans provide for the construction of a new engine room, the installation of a new engine and rope drive.

HANCOCK, MICH.—The Houghton County El. Co., of Houghton, has submitted a proposition to the Council for the installation of a street-lighting system on Front Street. The contract provides for the erection of 13 poles carrying one or two arc lamps as the Council directs.

MUSKEGON, MICH.—Arrangements are being made by the Brunswick-Balke-Collender Co. for building an addition to its boiler room before

the winter. The plans provide for a brick building 60 ft. by 80 ft. and 25 ft. high, and the installation of 1200 hp boilers. The present iron smokestack will be replaced with a concrete stack 175 ft. high with an interior diameter of 9 ft. Contracts have been placed for the stack. The company recently replaced some of its large motors with smaller motors.

NILES, MICH.—The Electric Appliance Co., of Chicago, Ill., has been awarded the contract for installing the new street-lighting system, consisting of 500-watt tungsten lamps, to replace the present arc lamps.

NILES, MICH.—The substation of the Southern Michigan Ry. Co., located in Niles, was badly damaged by an electrical storm recently, causing a loss of about $5,000. Two large rotary converters were injured.

SAULT STE. MARIE, MICH.—The Michigan Northern Pwr. Co., of Sault Ste. Marie, has applied to the State Railroad Commission for permission to issue $2,995,000 in capital stock and $2,000,000 in mortgage bonds to provide funds to make improvements made necessary to maintain the level of Lake Superior as ordered by the federal government.

TECUMSEH, MICH.—Special elections will be held in Tecumseh, Macon and Ridgeway for the purpose of voting on the proposition of granting the Tecumseh El. Co. a franchise to erect transmission lines through these townships to furnish electrical service. The company also proposes to furnish energy for lamps and motors in the villages of Ridgeway and Britton.

COSHOCTON, OHIO.—The Coshocton Lt. & Htg. Co. expects to install within the next three months a 5000-kva, 2300-volt General Electric turbine with condensing apparatus and 1000-hp boilers; also to erect 15 miles of three-phase, 33,000-volt transmission line and two substations, one at New Comerstown and the other at West Lafayette. All material for above improvements has been purchased. C. H. Howell is manager.

FINDLAY, OHIO.—The lighting committee has submitted a proposition to the Toledo, Bowling Green & Southern Trac. Co. giving the terms under which the City Council would renew the contract for street-lighting. The proposition submitted would necessitate the installation of new arc lamps (at least 200) throughout the city, the price not to exceed $55 per year for all-night and every-night service.

FRANKLIN, OHIO.—The Franklin El. Lt. Co. expects to purchase electricity from the Middletown Gas & El. Co., of Middletown. A transmission line is being erected from Middletown to Franklin to furnish energy here.

MINSTER, OHIO.—The Board of Public Affairs expects to purchase within the next six months a gas engine and generator for the municipal electric-light plant. H. B. Ruemann is secretary of board.

PAINESVILLE, OHIO—Within the next three months the managers of the municipal electric light plant expect to purchase one 200-hp boiler. O. W. Kile is secretary.

BLUFFTON, IND.—The Fort Wayne & Northern Indiana Trac. Co. has closed a contract with the Erie Stone Co., of Villa North, a suburb of Bluffton, to install electrical equipment at its plant there. The contract calls for a 500-hp motor to be in operation by Sept. 15.

INDIANAPOLIS, IND.—Preparations are being made by the Stenotype Co. for the construction of a new plant at Mars Hill, to cost about $500,000, including equipment. The plans provide for a power house, 45 ft. by 130 ft., equipped with two 250-hp boilers. The smokestack will be 150 ft. high. All machinery will be equipped for electrical operation and the company will generate its own power. Contract for construction of main building has been awarded to Henry Dellman, of Indianapolis. R. M. Bowen is general manager of the Stenotype Co.

LINTON, IND.—Plans and specifications have been prepared by S. W. Fries, superintendent of the municipal electric-light plant, for the installation of additional cluster lamps in the business district. The business men have offered to pay for the ornamental standards provided the city will take over and maintain the same.

CHICAGO, ILL.—Arrangements are being made by the North Clark Street Progressive Business Men's Association for the erection of cluster lamps along Clark Street from the river to North Avenue.

CHICAGO, ILL.—Bids will be received by the city of Chicago, Room 406, City Hall, Chicago, until Sept. 5 for furnishing nine direct-current electric motors, varying in size from 2 hp to 15 hp, at the water-works shops, 2304 South Ashland Avenue, Chicago, according to plans and specifications on file in the office of the Department of Public Works, Room 406, City Hall. L. E. McGann is commissioner of public works.

CHICAGO, ILL.—Bids will be received by the city of Chicago, Room 406, City Hall, Chicago, until Sept. 5 for furnishing and erecting two two-panel switchboards, one at the water-works shops, 2304 South Ashland Avenue, Chicago, and the other at Twenty-second Street pumping station, 2260 Ashland Avenue, Chicago, according to plans and specifications on file in the office of the Department of Public Works, Room 406, City Hall. L. E. McGann is commissioner of public works.

SHEBOYGAN FALLS, WIS.—The village of Sheboygan Falls has appointed a committee to negotiate with the Falls Lt. & Pwr. Co. for the purchase of its electric plant to be owned and operated by the municipality.

WARRENS, WIS.—The George Warren Co., of Warrens, expects to purchase within the next 12 months an engine (oil or gas) to replace the present steam equipment. F. R. Barber is manager.

AURORA, MINN.—The Northern Minnesota Pwr. Co., it is reported, will soon begin work on its water-power development south of Aurora. The proposed dam will be 16 ft. high and will generate sufficient energy to supply several villages in this vicinity. James H. Simons, of Aurora, is president.

BIG FALLS, MINN.—The installation of an electric-light plant in Big Falls is under consideration. A. M. Jenson, J. A. Richardson and others are members of a committee appointed to look into the matter.

BIRD ISLAND, MINN.—H. B. Rutledge, representing the Central Minnesota Lt. & Pwr. Co., of Glencoe, has been granted a franchise to install and operate an electric light system in Bird Island.

BREWSTER, MINN.—The Board of Water and Light Commissioners of the town of Worthington has submitted a proposition to the Village Council of Brewster offering to furnish energy for an electric-light system here from the municipal plant in Worthington.

CROOKSTOWN, MINN.—Bids will be received at the office of the State Board of Control, State Capitol Building, St. Paul, until Sept. 5 for erection and completion of the Boys' Dormitory Building at Northwestern Experiment Station, Crookston, including heating, ventilating, plumbing and electrical work and fixtures, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capitol Bank Building, St. Paul. Bids will be received collectively or separately. Copies of plans and specifications may be seen at the Builders' Exchanges at St. Paul and Minneapolis; at the superintendent's office of the Northwestern Experiment Station, Crookston, and at the office of the State Board of Control, Capitol Building, St. Paul.

ELY, MINN.—The town of Ely is installing an ornamental street-lighting system, consisting of 83 ornamental lamp standards carrying three-lamp clusters and 73 standards carrying five-lamp clusters. All material has been purchased. T. W. Tool is superintendent of the Light and Water Department.

ROCHESTER, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Sept. 2 for the erection and completion of power plant at the Rochester State Hospital, Rochester, including heating, ventilating, plumbing and electrical work and fixtures, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capitol Bank Building, St. Paul. Bids will be received separately and collectively. Copies of plans and specifications may be seen at the Builders' Exchanges at St. Paul and Minneapolis and at the superintendent's office at Rochester and at the office of the State Board of Control, State Capitol Building, St. Paul.

WOODLAKE, MINN.—Earl Jackson, of St. Paul, has been engaged to prepare plans and supervise the construction of the proposed municipal electric-light system. Energy for operating the system will be secured from Granite Falls, 12 miles distant. H. F. Payne is recorder.

AMES, IA.—Orders have been placed by the City Council for machinery to double the present output of the municipal electric-light plant, thus removing all possibility of the erection of a new plant. At a special election permission was given the Council to dispose of the present site and erect a new plant.

BAYARD, IA.—Bids will be received by the town of Bayard until Sept. 9 for the construction of a complete electric-lighting system, plans and specifications for which are on file at the office of F. E. Munger, town clerk.

BELLE PLAINE, IA.—The Belle Plaine El. Co. is installing a new 75-kw directly connected outfit and a 100-hp boiler. W. A. Mall is manager.

MARBLE ROCK, IA.—The City Council has passed an ordinance authorizing an issue of $24,000 in bonds for the construction of a dam across the Shell Rock River to furnish power to operate a lighting plant. The Power Engineering Co., of Minneapolis, Minn., has charge of construction of the dam.

MONTEZUMA, IA.—The Montezuma El. Lt., Pwr. & Htg. Co. expects to erect within the next six months a substation and to purchase material for distribution and lighting systems. George H. Husman is local superintendent.

AVA, MO.—Application has been made to the City Council by J. W. Pettit for a franchise to install and operate an electric-light system in Ava.

CARTHAGE, MO.—The Board of Public Works expects to purchase within the next two or three months boiler-room coal weighing apparatus and car and possibly stokers. A. P. Knowles is superintendent.

COLUMBIA, MO.—The managers of the municipal electric-light plant expect to purchase within the next six months one 750-kw turbo-generator unit complete with condenser and switchboard. Marion E. Fawks is chief engineer.

FAYETTE, MO.—The Fayette Lt., Ice & Coal Co. expects to install within the next 12 months a 300-hp Corliss engine directly connected to a 200-kw generator and to purchase within the next six months a tungsten street-lighting system to replace the present direct-current arc-lamp system. The company expects to build a 2000-ton storage room and operate ice plant all winter, using exhaust steam from electric plant. J. B. Bell is president.

KEARNEY, MO.—Arrangements are being made for the installation of an electric-lighting system in Kearney. Energy for operating the system will be supplied from the plant in Excelsior Springs.

ORRICK, MO.—The Orrick El. Co. expects to erect within the next

six or eight months a small ice plant and to purchase within the next six months one gas or oil engine and generator. Within the next 30 days the company expects to purchase lightning arresters, wire and meters and about 50 poles; also within the next two months some household labor-saving devices, including vacuum cleaners, washing machines and wiring devices, etc. C. T. Harding and E. W. Harding are owners.

ST. LOUIS, MO.—The Lt. & Devel. Co., of St. Louis, expects to erect within the next three months a transmission line from Sikeston to Morehouse, and from Illmo to Chaffee, all in Missouri. The company is now installing a 225-hp Diesel engine and a 160-kw, three-phase generator at its power plant in Mitchell, S. D. The main office of the company is in the Wright Building, St. Louis, Mo.

EDGELEY, N. D.—The board of managers of the municipal electric-light plant expects to purchase within the next six months one 60-kw, single-phase, 1150-volt generator. C. S. Rygh is electrician.

FINLEY, N. D.—The Finley Lt. & Pwr. Co. expects to erect an addition to its power house (18 ft. by 22 ft.) within the next two months and also to purchase an internal-combustion engine (15 hp to 20 hp), an 8-kw, 110-volt direct-current generator and a 3-amp to 5-amp booster and centrifugal pump. Frank E. Curry is superintendent.

MANDAN, N. D.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 19 for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Mandan, N. D. Drawings and specifications may be obtained from the above office or from the custodian of site at Mandan, N. D.

HURLEY, S. D.—Local business men are interested in a project to form a company for the purpose of taking over the Hurley electric-light plant. It is expected that improvements will be made to the plant and service.

ALLIANCE, NEB.—The Alliance Water and Light Department expects to purchase within the next six months one feed-water heater (300-hp capacity), one synchronism indicator, a few transformers and a small amount of weather-proof wire. The purchase of material for a series street-lighting system is also contemplated. Clare Dow is superintendent.

GENOA, NEB.—The managers of the municipal electric light plant expect to purchase in the near future one 10-kva or 12-kva tub transformer for series incandescent lamp-lighting system.

LOUISVILLE, NEB.—The City Council has granted two electric franchises to extend 50 years, one to the Lincoln-Omaha Interurban St. Ry. Co. and the other to the Continental Gas & El. Co., of Cleveland, Ohio, which operates electric plants in Beatrice, Plattsmouth and York. W. H. Abbott, of Cleveland, Ohio, is vice-president of the Continental company.

OMAHA, NEB.—The installation of a municipal electric-light plant in Omaha is under consideration. The city has lost a suit against the Omaha El. Lt. & Pwr. Co. to prevent it from selling power. The court decided that the company's franchise was perpetual although its charter expired in 1894. This decision did not make the franchise exclusive.

DODGE CITY, KAN.—The Midland Wtr., Lt. & Ice Co., of Dodge City, it is reported, is contemplating the installation of a new electric-light plant to furnish energy to farmers within a distance of 5 miles each way from the city to operate irrigation pumps. George Theis, Jr., is president and manager of the company.

HOLTON, KAN.—The Mayor and city commissioners have awarded the contract for furnishing engine and generator for the municipal electric-light plant to the Murray Corliss Engine Co., of Burlington, Ia. (390-hp engine connected to a 250-kw Fort Wayne generator), for $7,518.

HUTCHINSON, KAN.—The United Wtr., Gas & El Co., of Hutchinson, has under way the installation of an ornamental street-lighting system, covering 18 blocks. Each standard, of which there are to be 10 to each block, will carry four 100-watt lamps, maintained by underground wires. The company will do the work and the installation will cost approximately $15,000. J. F. Springfield is general manager.

TOPEKA, KAN.—The Atchison, Topeka & Santa Fé Ry. Co. is reported to be contemplating the construction of a new power plant in connection with its local shops, to cost about $100,000.

Southern States

MONROE, N. C.—The electric light commission expects to purchase within the next three months one centrifugal pump, 3-in. suction, 2½-in. discharge, directly connected to induction motor, to carry 60-lb. pressure, one car load of juniper poles, 10 lightning arresters, 500 glass insulators and 300 lb. weather-proof wire. W. H. Crow is superintendent.

MORGANTOWN, N. C.—The Board of Public Works expects to purchase within the next three months one second-hand 50-kw, 60-cycle, 2300-volt direct-connected unit. The board is now installing 150 Westinghouse wattmeters (type 00). R. W. Pepken is manager and F. J. Wortman superintendent.

WHITEVILLE, N. C.—A committee has been appointed by the city commissioners to make investigations relative to the installation of an electric-light plant, to be located in the central part of the town. The present plant, owned and operated in conjunction with a mill and gin, has been closed down.

BENNETSVILLE, S. C.—The managers of the municipal electric-light plant are installing an ornamental street-lighting system in the business district. Only part of the material needed has been purchased. E. C. Morrison is manager.

HAZLEHURST, GA.—The municipal electric-light committee expects to purchase within the next few months meters for water and light customers. At present the service is furnished at a flat rate. J. L. Brown is electrician.

NEWNAN, GA.—The generating plant of the municipal electric-light plant has been closed down and energy for operating the electric-light system is purchased from the Columbus Pwr. Co., of Columbus. W. B. Pringle is secretary of the Water and Light Commission.

LABELLE, FLA.—A 150-hp boiler is now being installed in the local electric-light plant, owned by E. E. Goodno.

LAKE BUTLER, FLA.—G. M. Richard, of Lake Butler, and John H. H. James, of Waycross, Ga., it is reported, will apply to the City Council for a franchise to construct and operate an electric-light system here.

NASHVILLE, TENN.—Bids will be received at the United States Engineer Office, Nashville, Tenn., until Dec. 11, 1913, for franchise for water-power development at Muscle Shoals, Ala., on the Tennessee River. For details see issue of March 29, 1913. Further information may be secured on application to Major H. Burgess, U. S. Engineer Office, Nashville, Tenn.

CULLMAN, ALA.—The city of Cullman expects to purchase within the next 60 days three motor-driven centrifugal pumps. B. Kiel is superintendent.

BELZONA, MISS.—The Water and Light Department expects to purchase within the next six months 300 25-ft. poles. J. J. Sisloff is superintendent.

ARKADELPHIA, ARK.—The Arkadelphia El. Lt. Co. has recently rebuilt its pole-line system. W. C. Maguire is superintendent.

BOONEVILLE, ARK.—Improvements are being made to the local electric-light plant, owned by Greenway & Harvey, including the installation of a 260-hp C. & T. engine and a 150-kw General Electric generator. R. M. Harvey is president.

MAMMOTH SPRING, ARK.—The East St. Louis Cotton Oil Co., National Stock Yards, Ill., is erecting a new cotton gin in Mammoth Spring, to be equipped for electrical operation, using 70-hp motors. Energy for operating the gin will be furnished by the Mammoth Spring El. Lt. & Pwr. Co.

MENA, ARK.—The Mena El. Lt. & Pwr. Co. expects to purchase within the next two months a tungsten street-lighting system consisting of 150 lamps.

NEWARK, ARK.—A franchise has been granted by the town of Newark, to L. P. and W. J. Caldwell to construct and operate an electric light plant here.

BATON ROUGE, LA.—The city of Baton Rouge is contemplating the installation of a municipal electric light plant and garbage incinerator.

MELVILLE, LA.—At an election held recently the proposition to issue bonds for the installation of a municipal electric-light plant and water-works system was carried.

DURANT, OKLA.—The Durant Ice & Lt. Co. expects to install a complete new plant within the next six months and to purchase two 300-hp boilers, two 312-kva generators and two engines to drive same and necessary exciters, pumps and accessories. W. J. O'Brien is manager.

DURANT, OKLA.—The managers of the municipal electric light plant expect to purchase within the next two months 4 miles of three-wire, three-phase transmission line to No. 6 electric pumping plant, and to purchase within the next 30 days one 100-kw polyphase intergrating wattmeter (switchboard type). E. S. Bennett is superintendent.

HENNESSEY, OKLA.—The Hennessey El Lt., Pwr. & Ice Co. expects to purchase within the next six months one 30-hp to 40-hp oil engine and generator and equipment for a 10-ton ice plant.

HOLDENVILLE, OKLA.—The Holdenville Ice & El. Co. expects to purchase within the next few months transformers for series street-lighting system and to install tungsten lamps. The company has recently installed a new 150-kw, three-phase, 2300-volt General Electric generator, and would like to dispose of a 90-kw, single-phase, 1100-2200-volt generator. W. M. Dunn is president and manager.

LINDSAY, OKLA.—The managers of the municipal electric light plant expect to purchase within the next 30 days a stock of inside material, including heating and cooking apparatus and labor-saving devices, etc. A. W. Simpson is superintendent.

BURNET, TEX.—The installation of an electric light plant in Burnet is under consideration. W. C. McDonald is reported to be interested in the project.

KERENS, TEX.—The Council has contracted with the Corsicana Gas & El. Co. for electrical service in Kerens. Work will begin at once on the erection of the transmission line between Corsicana and Kerens. J. W. Carpenter is president and manager of the company.

MARSHALL, TEX.—The city commissioners have granted the Marshall Trac. Co. a new franchise for its street railway in Marshall. Preparations are being made, it is reported, by interests connected with the railway to enlarge the local electric-light and power plant.

MEXIA, TEX.—Preparations are being made by the Mexia Lt., Wtr. & Sewerage Co. to equip its pumping plant, located 6 miles from Mexia, for electrical operation.

Pacific States

MORTON, WASH.—The Morton El. Co. is planning to construct a 250-hp hydroelectric power plant on the Tilton River, to cost about $10,000.

SEATTLE, WASH.—The Cascade Mining Company has offered its water rights on Miller River in the town of Benton, 2 miles from Skyhomish, to the city of Seattle for $90,000. The power site is within 40 miles of Seattle by the shortest route and 90 miles by railroad.

VANCOUVER, WASH.—The Lewis County Commissioners have granted the Independent Lt. & Pwr. Co. a franchise to erect transmission lines from the north line of the county at the Woodland Bridge to the north line of the city of La Centre, and from the south line of La Centre to the north line of Vancouver.

YACOLT, WASH.—The Northern Clarke County Lt. & Pwr. Co., of Yacolt, has recently established a day service. The company is now erecting a line to connect up a 20-hp motor to operate a rock crusher. C. R. Miller is engineer.

BAKER, ORE.—The City Council has accepted the plans of Stannard & Richardson, of Portland, for the construction of a municipal lighting plant, bids for which will soon be asked.

EUGENE, ORE.—Contracts have been closed whereby the Oregon Pwr. Co., of Albany, will furnish energy to the Portland, Eugene & Eastern Ry. Co. for all its railway lines now in operation and all proposed railways as far north as Salem. The service will be furnished from the Springeld plant. In addition to the present line, carrying 11,000 volts, a 33,000-volt transmission line will be erected to Albany, which will be looped back by the way of Corvallis to Monroe.

PORTLAND, ORE.—A plan for the construction of a municipal electric-light plant for the city of Portland is being prepared by Commissioner Daly of the Public Utilities Department. Water rights on the Zigzag River, in the Mount Hood district, 40 miles from Portland, have recently been secured by the city, and it is estimated that 7000 hp can be obtained with practically no development. By constructing reservoirs a much larger amount of power may be obtained.

WARRENTON, ORE.—The Pacific Pwr. & Lt. Co., of Portland, has applied to the City Council for a franchise to furnish electrical service in Warrenton.

ELSINORE, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, is planning to extend its transmission along Grand Avenue to the Lakeland Ranch, a distance of 5 miles. The proposed line will cost about $8,000 and will furnish energy for lamps and to operate pumps for irrigating purposes.

EUREKA, CAL.—The Secretary of the Interior has granted the petition of Frank and Carl Langsford, of Eureka, for a right-of-way for their water canals through the national forest at the Big Bend of the Klamath River. They hold water rights to the amount of 500 in. in the Klamath River, and it is understood that work will begin immediately on the construction of an electric plant at Ishi Pishi Falls.

FRESNO, CAL.—The San Joaquin Lt. & Pwr. Co., of Fresno, expects to install within the next few months additional hydraulic capacity at Kern Canyon and at No. 2 North Fork, aggregating about 11,000 kw, and to increase the output of the steam plant at Bakersfield by 6250 kw. All equipment has already been purchased. A. G. Wishon is general manager.

GRANITEVILLE, CAL.—Arrangements are being made to erect a large power plant on Weaver Lake, 10 miles from Birchville, to furnish electrical energy to the Birchville mine near Graniteville. John A. Bunting is president of the Birchville Mining Co.

PASADENA, CAL.—The city of Pasadena is installing a 400-hp Stirling boiler with superheater and one 25-kw exciter in the municipal electric light plant, also several miles of pole lines in new addition to city, and is erecting ornamental street lamps on 6 miles of streets, maintained by underground conduits. C. W. Koiner is general manager of the municipal electric light plant.

RIVERSIDE, CAL.—The city of Riverside has acquired the domestic water system owned by private companies and has consolidated it with the municipal electric-light and water department under one management. No immediate improvement is contemplated to the lighting department, but the water system will be almost entirely rebuilt. Plans are now being prepared. Joseph H. Cox is general manager of public utilities.

SAN FRANCISCO, CAL.—At an election held Aug. 26 the proposition to issue $3,500,000 in bonds for municipal traction lines was carried.

SANTA ANA, CAL.—The Pacific El. Co. has abandoned its plans to establish a power plant and railroad yards on the site at Fourth, D, Fifth and Lacey Streets. The power plant located at the corner of Fifth and Lacey Streets will be moved to North Main Street and will be located on or near Santiago Creek.

SANTA BARBARA, CAL.—The Santa Barbara Gas & El. Co. has recently purchased one 1000-kw, 2200-volt General Electric Co. turbo-generator set, one 4000-sq. ft. Wheeler Condenser & Engineering Co. condenser, with two vertical hot-well pumps and rotary dry-vacuum pump and two 25-kw exciters, one turbine-driven and one motor-driven. H. W. Dennis is construction engineer.

HAILEY, IDAHO.—The Beaver River Pwr. Co., of Beaver, Utah, has filed formal acceptance of its franchise with the city clerk. Under the terms of the franchise the company is to furnish electrical energy in Hailey before May, 1914.

IDAHO FALLS, IDAHO.—The City Council is contemplating the installation of two additional 750-hp units in the municipal electric-light plant.

MALAD CITY, IDAHO.—The Evans Lt. Co., of Malad City, expects to purchase within the next 30 days 10 or 12 flaming-arc lamps as an addition to street-lighting contract. Preparations are being made by the company for changing its present single-phase system for three-phase distribution. J. H. Campbell is manager.

OGDEN, UTAH.—Preparations are being made by the Utah Pwr. & Lt. Co. for the erection of two transmission lines in this section of the State. The principal line (steel towers) will extend from North Ogden, where it will connect with the company's present line north to Grace. The other line, on which the engineers are now working, a wooden-pole transmission system between Ogden and Devil's Slide, in Weber Canyon, will furnish energy to operate the plant of the Union Portland Cement Co. Energy will be transmitted at 45,000 volts from the company's main line at the Uintah station.

DILLON, MONT.—The Union El. Co., of Dillon, has recently placed orders for one 360-hp Leffell turbine, to be delivered in October.

FORT BENTON, MONT.—The Benton El. Lt. Co., of Fort Benton, expects to purchase within the next 30 days 40 30-ft. (6-in. top) poles and about 1000 lb. No. 10 weather-proof wire. George L. Overfield is secretary and manager.

KALISPELL, MONT.—The Northern Idaho & Montana Pwr. Co., of Kalispell, it is reported, has sold its plant to the Chicago, Milwaukee & St. Paul R. R. Co. The railway company is equipping its railroad for electrical operation in this section.

THOMPSON FALLS, MONT.—The Town Council has signed a contract with the Thompson Falls Pwr. Co. providing for the installation of a street-lighting system for the town. W. E. Hadley is manager of the Prospect Creek plant.

TOWNSEND, MONT.—The Montana Power Co., of Butte (which has purchased the municipal electric-light plant), expects to change the local system from 2200 volts to 60,000 volts within the next three months and to install within the next two months a series tungsten street-lighting system. A. E. Davidson is local manager.

LAS CRUCES, N. M.—The Las Cruces El. Lt. & Ice Co. has recently completed an ice plant, using exhaust steam.

TUCUMCARI, N. M.—The Tucumcari Lt. & Pwr. Co. expects to erect within the next 18 months a one-story fireproof power house, 60 ft. by 100 ft., and to purchase one 200-hp water-tube boiler, one 150-kw generator and a four-valve engine (directly connected), one generator panel and one two-circuit feeder panel; also within the next 12 months shaking grates and belt-driven boiler-feed pump. S. B. Richey is resident manager.

Canada

CALGARY, ALTA.—Tenders will be received by the city of Calgary until Sept. 3 for furnishing lamp standards for luminous-arc lamps. Plans and specifications may be obtained at the office of the city electrician. J. M. Miller is city clerk.

ROSSLAND, B. C.—Preparations are being made for equipping the Canadian Pacific Railway branch between Rossland and Castlegar, a distance of 30 miles, for electrical operation. Direct current from the power plant at Bonnington Falls will be used and the trains will be operated by large electric locomotives. Overhead wires will be used.

WARDNER, B. C.—The planer and electric plant of the Crows Nest Lumber Co., of Wardner, was recently destroyed by fire, causing a loss of about $40,000.

NEW TORONTO, ONT.—The Village Council has passed a resolution asking the Hydro-Electric Power Commission of Ontario to begin work on the installation of the system at once instead of waiting until autumn. The Council has recently passed the by-law appropriating funds for the installation of the system.

PARRY SOUND, ONT.—Three 22-kva constant-current transformers are now being installed in the municipal electric-light plant to supply energy for the new street-lighting system (tungsten 6.6-amp lamps), consisting of 50 four-lamp clusters (80-cp. lamps) and 50 single lamps of 60 cp on pole fixtures (Westinghouse apparatus). The work is being done under the supervision of G. Groves, superintendent of the municipal plant.

TORONTO, ONT.—The city of Toronto has decided to erect cluster lamps of 500 cp over the center of the roadways at important corners in the city and to install cluster lamps of 300 cp at the less important intersections.

TORONTO, ONT.—The Toronto Hydro-Electric system has received permission to erect a temporary substation in the northeast corner of

Withrow Park, as the permanent station at Coxwell and Gerrard Streets will not be ready for about six months.

HULL, QUE.—The E. B. Eddy Co., Ltd., is building a new hydro-electric power plant and pulp mill in Hull at a cost of about $750,000. The output of the power plant will be increased from 8500 hp to between 16,000 hp and 18,000 hp. The company is also deepening and enlarging the forebays and intakes of its plant and increasing the draft tubes.

REGINA, SASK.—Tenders will be received by the city commissioners of Regina, Sask., until Oct. 1, for furnishing coal bunkers, ash hoppers, coal and ash conveyors and crushers. Specifications may be obtained from E. W. Bull, superintendent of Light and Power Department.

New Incorporations

TARPON SPRINGS, FLA.—The Citizens' Ice & Lt. Co. has been organized with a capital stock of $25,000 by I. B. Read, J. K. Cheyney, L. S. Fernald, N. A. Van Winkle and others.

PORTLAND, ME.—The Dominion Trac. & Ltg. Co. has filed articles of incorporation under the laws of the State of Maine with a capital stock of $5,000,000. The company proposes to construct, acquire and operate railways, etc.

LEBANON, PA.—Charters have been granted by the State Department to the North Londonderry and Stauffer Electric Companies. Each company is capitalized at $5,000 and the incorporators are: Abraham G. Stauffer and Oscar Stauffer, of North Londonderry, and George Woodward, of Philadelphia.

BERRYVILLE, TEX.—The Berryville Tel. Co. has been chartered with a capital stock of $10,000 by W. G. Hanbury, R. E. Norris, Thomas Morris and others.

PARK PLACE, TEX.—The Park Place Wtr., Lt. & Pwr. Co. has been incorporated with a capital stock of $10,500 by G. J. McCarty, F. A. Tucker and Lewis Fogle. Post office address, Houston, Tex.

RAYMOND, WASH.—The Willapa El. Co. has been incorporated with a capital stock of $400,000 by J. S. Thornton, R. L. Fisher and M. M. Fisher.

SPOKANE, WASH.—The Spokane Valley Pwr. Co. has been incorporated with a capital stock of $200,000 by J. W. McBride, Fred A. Kragelund, L. Timberman, V. E. Bayless and T. J. Meenach. The company proposes to produce and distribute water-power.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 19, 1913.

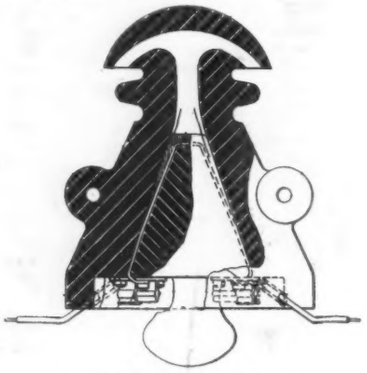
[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

1,070,387. PUSH-BUTTON; J. D. Baldwin and J. J. Schlegelmilch, Cleveland, Ohio. App. filed Aug. 5, 1912. Indicator for door signal.

1,070,398. APPARATUS FOR AND METHOD OF CLEANING GASES; H. A. Brassert and R. W. Cousins, Chicago, Ill. App. filed April 7, 1908. Condensation of moisture and magnetic separation of magnetic material.

1,070,407. TELEGRAPH TYPEWRITER; A. D. Cardwell, New York, N. Y. App. filed Dec. 2, 1910. Successive selection of groups of working magnets.

1,070,426. INCANDESCENT-LAMP LOCK AND SEAL; H. Davies and J. Cooke, West New York, N. J. App. filed Nov. 20, 1912. Riveted split shell with locking flange.



1,070,452.—Fusible Cut-out.

1,070,432. BOW CONTACT FOR TROLLEYS; M. Ergenzinger, Atlanta, Ga., and H. S. Day, Brooklyn, N. Y. App. filed June 25, 1910. Pantograph support for a plurality of independent resilient contact strips.

1,070,437. DYNAMO-ELECTRIC MACHINE; T. Ferguson, Altringham, England. App. filed May 15, 1909. Automatic regulation of variable speed for train lighting, ventilating, etc.

1,070,452. FUSIBLE CUT-OUT; G. B. Griffin, Edgewood, Pa. App. filed Oct. 31, 1910. Line insulator with plug.

1,070,454. ELECTROLYTIC CELL; T. Griswold, Jr., Midland, Mich. App. filed June 15, 1911. Bi-polar electrode. (Improvement on patent No. 987,717.)

1,070,456. MEANS FOR CONTROLLING ELECTRIC CIRCUITS; J. H. Gugler, Milwaukee, Wis. App. filed Sept. 22, 1910. Automatic unidirectional switch for use in charging storage batteries, etc.

1,070,492. WINDING FOR DYNAMO-ELECTRIC MACHINES; B. G. Lamme, Pittsburgh, Pa. App. filed Jan. 26, 1910. Armature winding for commutator of high-speed direct-current machine and single phase alternating-current machine.

1,070,505. SIGNAL SYSTEM; J. H. Mattice, Clyde, Kan. App. filed May 26, 1911. Electromagnetically operated selective control.

1,070,542. HIGH-TENSION RECTIFIER FOR ALTERNATING CURRENTS; L. Schmidt, Hanover, Germany. App. filed March 26, 1912. Mechanical details of rotary type.

1,070,546. AMUSEMENT DEVICE; J. F. Sherlock and H. Spengler, New York, N. Y. App. filed Sept. 10, 1909. Device magnetically operated on a globe.

1,070,564. LOCOMOTIVE DRIVING CONNECTION; J. E. Webster, Pittsburgh, Pa. App. filed Jan. 10, 1912. Yielding to avoid shocks.

1,070,568. METHOD OF MELTING METALS AND ALLOYS; R. S. Wile, Pittsburgh, Pa. App. filed Nov. 22, 1911. Electrically heated inert bath.

1,070,577. ELECTROMAGNETIC DRIVE FOR SECONDARY CLOCKS OR THE LIKE; A. O. Benecke, Foxboro, Mass. App. filed June 7, 1911. Escapement and ratchet.

1,070,597. CONTROLLING DEVICE; W. H. Gaulke, Milwaukee, Wis. App. filed Aug. 12, 1912. Alternating-current rheostat-starting device. (Improvement on patent No. 1,009,661.)

1,070,614. INSULATING JOINT; C. A. Kraus, Newton Highlands, Mass. App. filed Aug. 27, 1909. Gas-tight pipe joint.

1,070,615. ELECTRIC LEAD FOR VAPOR-ELECTRIC APPARATUS; C. A. Kraus and R. D. Mailey, Newton Highlands, Mass. App. filed June 30, 1910. Cathode lead with a hollow foot.

1,070,629. ADJUSTABLE FIELD RHEOSTAT; P. J. Ray, Lakewood, Ohio. App. filed Sept. 3, 1912. Automatically cuts out resistance.

1,070,638. CONTROL SYSTEM FOR ELECTRIC MOTORS; L. H. Thullen, Cincinnati, Ohio. App. filed Dec. 11, 1912. Feed carriage for friction saw.

1,070,647. REVERSIBLE ELECTRIC MOTOR; G. H. Whittingham, Pikesville, Md. App. filed March 19, 1912. Pilot controlling motor.

1,070,648. CONTROL SYSTEM FOR INDUCTION MOTORS; G. H. Whittingham, Baltimore, Md. App. filed Dec. 12, 1912. Starting and running control with variable resistance.

1,070,651. ALTERNATING-CURRENT REGULATOR; J. J. Wood, Fort Wayne, Ind. App. filed Feb. 24, 1910. Series connection. (Improvement on patents No. 720,305 and No. 765,948.)

1,070,657. CONTROLLER SWITCH; V. G. Apple, Dayton, Ohio. App. filed Aug. 8, 1912. Direct-current machine with storage battery for starting gas engines, etc.

1,070,658. TROLLEY-WHEEL CONSTRUCTION; W. H. Arnold, Stockton, Cal. App. filed Dec. 26, 1912. Simplified form of bearing.

1,070,673. ELECTRICAL HEATER; A. Eimer, New York, N. Y. App. filed March 26, 1912. Expansible tube.

1,070,674. ELECTRIC SWITCH; R. H. Fenkhausen, San Francisco, Cal. App. filed Sept. 4, 1912. Normally locked knife switch.

1,070,726. HARMONIC SELECTIVE TELEPHONE SYSTEM; A. F. Poole, Wheeler, W. Va. App. filed Feb. 4, 1907. Combination of selective currents.

1,070,734. ELECTRIC HEAT ACCUMULATOR; A. Rittershaussen, Cassel, Germany. App. filed Jan. 4, 1912. Water circulation.

1,070,743. DEVICE FOR PROTECTING ELECTRIC LINES AND APPARATUS AGAINST OVERTENSION; S. De Stefani, Verona, Italy. App. filed Oct. 16, 1912. Lightning arrester with improved ground.

1,070,769. ARC LIGHT; W. E. Brown and L. C. Granger, Milwaukee, Wis. App. filed Sept. 15, 1911. Carbons at 90 deg. for moving-picture machines, etc.

1,070,777. ELECTRIC SWITCH; R. V. Collins, New York, N. Y. App. filed July 14, 1909. Magnetically operated railway switch with sealing cup.

1,070,793. BRUSH-HOLDER ATTACHMENT FOR MAGNETOS; O. Fischer, Stuttgart, Germany. App. filed April 24, 1913. Invertible brush holder.

1,070,899. CABLE CONNECTOR; F. Kratz, Stuttgart, Germany. App. filed June 1, 1910. Conducting sleeve for ignition apparatus, etc.

1,070,904. SAFETY LOCK; G. C. Maxwell, New York, N. Y. App. filed Jan. 12, 1911. Signal cord lock for railroad cars.

1,070,935. ELECTRICAL SWITCH; C. Aalborg, Wilkinsburg, Pa. App. filed Dec. 6, 1907. Solid-contact member with resilient pressure.

1,070,936. INTERLOCKING DEVICE; C. Aalborg, Wilkinsburg, Pa. App. filed July 13, 1910. For hand-controlled switches.

1,070,945. CONTROLLING SYSTEMS FOR RECEIVING APPARATUS; A. D. Cardwell, New York, N. Y. App. filed Nov. 14, 1911. Telegraph-typewriter recorder.

1,070,948. CABLE AND TUBE COUPLING; T. W. Dodd, Des Moines, Ia. App. filed May 6, 1912. Shaped out of sheet metal.

1,070,966. ELECTRIC WELDING; C. H. Kicklighter, Pasadena, Cal. App. filed Dec. 18, 1911. For welding long pipe joints.

1,070,970. BUFFING DEVICE; L. V. Lewis, Edgewood Park, Pa. App. filed Jan. 11, 1912. For absorbing momentum in the vane type of relay.